THE
TECHNICAL REPOSITORY,

CONTAINING

Practical Information

ON SUBJECTS CONNECTED WITH

DISCOVERIES AND IMPROVEMENTS

IN THE

USEFUL ARTS.

BY THOMAS GILL, *Patent-Agent*,

UPWARDS OF TWENTY YEARS A CHAIRMAN OF THE COMMITTEE OF MECHANICS IN THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE, ADELPHI, AND HONORARY MEMBER OF THE ROYAL PRUSSIAN ECONOMICAL SOCIETY OF POTSDAM.

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culty of managing these tools, when held in the ordinary handles; and, indeed, the necessity of it has been felt and obviated by workmen in different ways, as we shall hereafter have to mention; but by none in a superior manner to that here shown.

An excellent example of a tool, formed on this principle, has been afforded by that scientific mechanic, Mr. Brunel, in his celebrated block machinery at Portsmouth, in the tool employed by him for turning the wrought-iron pins, cylindrical, upon which the hard-wood sheaves turn in the blocks; the pins being also greatly improved in hardness and durability by being subsequently *burnished,* in a most ingenious manner.

This tool is simply a steel cylinder, properly hardened and tempered, and having its top ground off flat at a proper cutting angle, see fig. 12. It is held upright, and carried along gradually and uniformly in a rectilinear direction, by being placed in a proper carriage affixed to the machine, and urged forwards by a screw. The oval figure, N, is a representation of the flat face of the tool, viewed in front.

Another example we quote, from the successful practice of an old, experienced, and excellent workman, in a large manufacturing town, in the central part of the kingdom; and which practice is well observing of adoption. He was exceedingly partial to the use of *hook-tools,* in rough-turning and finishing wrought-iron, and even well annealed steel. These hook-tools are already known, as being employed in scooping cavities in wood in the lathe; but are by no means so well known to, or employed by the turners in metal. Fig. 13 is a top view of this tool in its rounded form, and which was used by the workman alluded to, in *rough-turning* cylinders; and fig. 14, the *straight form* given to its edge, for *finishing* the cylinders. These tools he forged out of a square or half flat bar of good cast-steel, one end of which he drew out into the shape shown flatways in fig. 15, and endways, or in section, in fig. 16: that is, he spread the steel by the hammer, to a thin edge on each side, having a *cress*, or swelling, in the middle of it. He always planished or condensed the steel well, by hammer-hardening it till it was cold, and then filed the tool into shape, previous to bending it into the rounded or flat hooked form, as required, at a red-heat; observing to turn the *cress* or swell inwardly; and, lastly, carefully hardened and tempered it. He had then only to grind one of the two edges of the tool, outwardly, and accurately into shape for use, leaving the other edge unground, to lodge upon the lathe-rest; as it would have become blunted thereby, had it been at first ground thin enough for turning with. When, however, the first edge had, by repeated grinding, become unfit for use, the other took its turn; and when, finally, that had also been worn down, he broke off the remaining part, and again drew out another hook, as at first. We may, however, add, that had he *annealed his steel*, in the manner described in our second volume; viz. *by heating it just short of the hardening heat, and instantly quenching it, the condensing effect of the hammer would have been much greater upon it.*

(To be continued.)

II.—*On the Blowing of Air into Furnaces by a Fall of Water. By the late celebrated* William Lewis, *M.D.*

(Continued from page 333.)

Experiments of the proportional Bores of the Funnel and Pipe.

We have already seen, that unless the throat of the funnel is less than the pipe, the quantity of air carried down will be inconsiderable; and that by lessening it further than to a certain point, the effect is also diminished. To hit this precise point is not perhaps possible; and the point which is the most perfect proportion for one height of water, cannot be so for any other; an increase of the pressure, disposing the jet to spread more, and fill a larger bore.

It appears from some experiments already mentioned that when the whole height of the fall of water is fifteen feet, the height of the pipe ought to be nine feet, and that of the funnel six. This being as low a fall as these kinds of machines have generally been erected for, and as high a one as is generally to be expected in this country, I made several trials for adjusting the proportions to those heights; using for the funnel, a tapering copper pipe, into the lower end of which were occasionally inserted smaller pipes, of different bores.

By trying several of these funnels we came to certain sizes, which could not be much increased or diminished, without diminishing the effect of the machine; but if there is, in this respect, any exact standard, our experiments did not discover it. There are so many circumstances, as we have already seen, which influence the effect, that it is very difficult to judge, when the differences are small, how far they depend on any particular one. When the area of the orifice of the pipe was from four to five times greater than that of the funnel, the differences in the height of the gauge were not very considerable: the due proportions seem to lie within these bounds; and perhaps nearer to the latter than to the former; for when the funnel was only about the sixth part of the area of the pipe, the gauge stood rather higher than when it was a third part; from whence, the proportions should be as one to somewhat more than four and a half.

Experiments of dividing the stream, so as to increase its effects, and render less water sufficient.

As the effect of these kinds of machines depends on the water being spread and divided; and the air, which comes in to fill the interstices between the little streams, or drops, which compose the jet, being pushed down with velocity, by the succeeding water; I have endeavoured to divide the stream more effectually than is done in the common machines, and with little or no diminution of its velocity, by varying the form of the aperture of the funnel.

On the orifice of the funnel, I fitted a perforated tin plate, like the nose of a watering-pot, but with the holes larger, and of a triangular figure; this figure was chosen on account of its great surface; water passing through a triangular aperture having about a third part more surface than through a circular one of equal area: some more holes were made round the sides, in such positions that the streams issuing from the higher holes might no where fall upon, or coincide with those from the lower ones; but that the water might be uniformly dispersed through the whole cavity of the pipe. By this division of the water it was made to fill a much larger bore than otherwise, and to produce as great an effect as the full quantity of water which the same pipe would otherwise have required; insomuch, that quantities of water which had little effect in the common way of application, were, by this contrivance, made to yield a strong blast.

This method is, however, accompanied by an inconvenience, which often showed itself in the course of the experiments; and which must be more considerable, in the continued working of the machine. After it had acted vigorously for some time, its action frequently abated of a sudden; the blast from the blowing pipe grew weak, and the gauge sunk: sometimes its force increased again in a little while; but, for the most part, it continued to diminish more and more. The cause was discovered to be bits of leaves, and other like matters, which the water had carried into the funnel, and which had in part stopped up the small apertures. The remedy was obvious, letting the water pass from the reservoir through a wire sieve, whose holes were much finer than those of the funnel; and doubtless an expedient of the same kind would prove effectual for the largest machines. It is, in all cases advisable to have the water pass through a grating before it enters the funnel, even the common large apertures being sometimes choaked up, by matters which the stream brings along with it. Where scantiness of water, or want of so high a fall as is commonly required, persuade to this contrivance for procuring a more effectual division of it, and for augmenting its power, with its surface; two or three gratings, or perforated planes, with apertures of different sizes, will be necessary; one, with very fine holes, much smaller than those of the cullender; that nothing can get through the former, which can be in danger of sticking in the latter: another with larger apertures, for detaining weeds and such other matters as would soon obstruct the finer strainer.

I have tried other methods of procuring this dispersion of the water, by making the throat of the funnel of different figures, but with little success. Whether the throat was made converging or diverging, in greater or lesser degrees, there did not appear to be any material difference in the effect of the machine. I introduced into the funnel a cylindrical core, which was fixed in the middle of it, by means of pins projecting from it, so as to leave a circular aperture all around it; and this core was sometimes solid, and sometimes a pipe, which reached above the funnel, and carried down air into the middle of the jet below; but no other difference was observed in either case, but what arose from the necessary diminution of the quantity of water. It is probable, indeed, that by duly proportioning the core to the funnel, and the width of the pipe to the sheet of water, falling round the core, the effect, by the division of the stream, would be greater than an equal quantity of water would produce when falling in one column; though the increase obtainable by this method did not promise to be considerable enough to deserve the troublesome investigation of the proportions. One trial, however, depending partly on this principle, appeared of some importance to be made.

As the water-machine of St. Pierre is said to have two apertures in the bottom of the funnel, whose streams as they issue out cross one another, and are dashed into drops, I tried to answer this intention by using for the funnel a wooden trunk, with two of its sides sloping downwards, so as to leave a long narrow aperture between them; in the middle of this aperture, and parallel to the inclined sides, was placed a wedge, of the same slope with the sides of the funnel, that the water might pass out in two sheets, directed towards one another.

The funnel was at top about eight inches square; its width at bottom, seven inches and eight-tenths, by one inch and nine-tenths. The wedge dropped into it entirely stopped the lower aperture, and had its thin edge hanging down considerably below it: slips of wood of different thicknesses fastened on the wedge occasionally, two on each side, prevented its falling down so far, and procured spaces of different widths, between it and the sides of the funnel, so that the water could be reduced at pleasure into two sheets, seven inches and eight tenths wide; and from less than a quarter of an inch to three quarters of an inch thick; the partition in the middle reaching in all cases lower down than that which confined them on the sides, that they might not unite into one, upon their discharge from the throat. Along the sloping sides of the funnel were two air-pipes, of the same breadth with them, and about an inch and a half wide; so that at the bottom there were three oblong rectangular apertures; the middle one with a wedge in it for the water, and the two lateral ones for air; the outsides were continued about seven inches and a half below these apertures, so as to form a large cavity for the water to spread in.

The funnel above the throat was somewhat more than three feet high, on the top was fitted a wooden pipe, nearly of the same width with it, and four feet eight inches high. The top of this pipe passed up through a rectangular cistern, nearly 168 inches in length, and 96 in width, and which consequently contained about fifty-seven gallons on every inch in depth. For admitting the water two holes were made, in two opposite sides of the pipe, about ten inches high, with two sliders fitted to them, for occasionally varying their height; and consequently the quantity of water received. On the outside of each hole was fixed an iron plate, perforated with numerous small holes, to keep back such matters as might choak up the throat: that the holes might be sufficient to allow water enough to pass in, the strainer was made wider than the aperture in the pipe, and bent to a semi-cylindrical form.

To the bottom of the funnel, enlarged as above-mentioned, was fitted a pipe, six feet high, and in width four inches by seven and a half. The lower end of this pipe was inserted into the head of a large cask, without a bottom, which was set in a tub above three feet deep, with three supports under the lower edge of the cask, to procure a space between it and the bottom of the tub, for the water to pass freely off. About eight inches under the orifice of the pipe, a round board, for the water to fall upon, was hung by three cords, which passed up through the head of the cask, and were secured by pegs. At one side a tin vessel, full of water, was supported in the same manner; and through a faucet, over the middle of this vessel, was inserted a glass tube, thirty-four inches long. At the other side was the blast-pipe, about three-quarters of an inch in diameter.

The machine being thus prepared, we proceeded to the trial of it, expecting that the two streams, from their strong direction towards one another, would cross, and be dashed into drops, and carry down abundance of air. But in the effect we were greatly disappointed: the blast was weak, and the gauge rose to no considerable height, whether the wedge was dropped down or raised up, so as to suffer the water to pass in lesser or greater quantity, in thin or in thick sheets; in continued trials and variations of the apertures for three or four days, the gauge was not once observed to rise so high as ten inches. A good deal of air, indeed, escaped through the junctions of the pipe, and of the air vessel; but not near enough to make up the expected quantity.

The wedge answering so ill, it was laid aside; and in its place was introduced a leaden vessel, of the same shape with the funnel's throat, and of such a size as to rest against the sides of the aperture, by its upper edge, and hang six or seven inches down in the wider part of the pipe: in the sides and bottom of this vessel were made several holes, about two-tenths of an inch in diameter. With this alteration I had the pleasure to find that though air rushed out from the joints, even more plentifully than before; yet the blast from the blowing-pipe was strong, and the water in the gauge-pipe rose to the top, and run over.

I tried to measure the quantity of water necessary for producing this effect, for a certain time. The reservoir being filled to the depth of fourteen inches, the gauge rose as before, and continued high for four minutes; after which it began to sink fast; the water in the reservoir having then become too low to keep the pipe full, though it continued to run for a considerable time longer. From the dimensions of the reservoir already mentioned, it will appear, that if all the water had run out in the four minutes, it would have amounted to near two hundred gallons in one minute; but at least a fourth of it remained after that period; so that the expense could not exceed a hundred and fifty gallons in a minute. We could not expect any very great accuracy in this determination, because, as the height of the water continually decreased in the reservoir, its velocity likewise decreased; so that if a due quantity run in the last minute, a superfluous quantity must have run in the first.

The leaden cullender being taken out, and the whole throat left vacant for the stream, the gauge still rose to the top; but the expense of water was now more than double to what it was before.

These trials, though not carried to such a length as I could have wished, satisfied me and those who assisted at them, that much more air is to be obtained by dividing the stream by means of a cullender, than by any other methods that have been tried; and that *with such a machine as is above described, a stream of a hundred and fifty gallons, at most, in a minute, is sufficient to produce a continued blast, from a pipe of three-quarters of an inch bore, of such a strength as to support a column of water of three feet or more.*

To afford as much assistance as possible to those who may be desirous of erecting machines of this kind, I shall here collect into one view the most material particulars which my experiments have discovered, with regard to the perfection of their structure, and form from them a description of such a machine as promises to be most effectual.

The bottom of the reservoir of the water should be about fourteen feet above the level of the ground; we need not be very solicitous about procuring a greater height; for though a greater would be of some advantage, yet this advantage appears to be much less considerable than has been commonly imagined. In the channel by which the water is conveyed, are to be placed gratings of different sizes, as already mentioned; and before the aperture a finer grating, which may either be a perforated iron plate, or a wire sieve, to serve as strainers for keeping back such matters as would obstruct the apertures which the water is afterwards to pass through. The stream should enter at one side, or be so managed that the water in the reservoir, or funnel, may not be agitated by it, or put into a spiral motion, which our experiments have shown to be very injurious.

In the bottom of the reservoir is to be made a round hole, for admitting the upper end of what we have hitherto called the funnel, but which may here be more conveniently a cylindrical pipe of copper or of cast-iron, five or six inches in the bore, and seven feet long. To the end of this pipe is to be fitted a cullender, about a foot long, with the holes triangular, of about half an inch on each side; and six or seven stripes from top to bottom, at equal distances, preserved without any holes, for admitting air to pass down to the lower streams. All the holes should be directed downwards, that the streams may not be forcibly projected against the sides of the pipe which is to receive them, so as to have their velocity too much diminished.

If there are six of the perforated spaces in the cullender, the number of holes in each may be twenty, so that the whole number of holes will be one hundred and twenty. The side of each of the triangular holes being half an inch, the area of each will be the eighth part of a square inch; and the sum of their areas will be fifteen square inches. The quantity of water running through one aperture of such an area, at the depth of seven feet and a half under the surface, comes out, on calculation, about six hundred and twenty-two gallons in a minute; but the real quantity will doubtless be much less than this, on account of the great friction of the water, in passing through a number of small holes, and of the resistance of the air, which increases in a very high ratio, according to the increase of the velocity, and enlargement of the surface; it is in part to make up for these retardations, that the pipe is directed to be made so high. The surface of the water is here above thirteen times greater than if it passed all through one circular aperture.

Both the pipe and the cullender should have a flanch, or rim, round their orifices; and be secured to one another by screws passing through the rims of both, with a plate of lead between them, to make the juncture tight, as commonly practised in joining iron pipes for water-works.

This way of joining them permits the cullender to be taken off and cleaned, when a diminution of the effect of the machine shows the holes to be choaked up; which, however, it is apprehended will seldom happen.

As the holes will permit more water to run through than may at all times be wanted, it is proper to have some contrivance for occasionally closing a part of them. This may be effected by means of a thin copper pipe, open at both ends, as high as the cullender; and of such width as just to drop into it. It will be easily conceived, that when this register is let entirely down, the lateral holes will be covered, and the water admitted only to those in the bottom of the cullender; and that by raising it further and further, more and more of the lateral holes will be uncovered. The register is to be hung by a wire, to a cross bar over the reservoir, by which wire it may be raised and lowered, and a scale, or divided board, may be adjusted against the upper part of the wire, for showing the height of the register, or the number of holes closed by it.

The most commodious and effectual way of admitting air to the water appears to be, that of our first experiments; viz. hanging the throat of the funnel, in this case the cullender, within the wider receiving pipe; for by this means the air is admitted freely and uniformly all round. This last pipe should likewise be of iron or copper, twelve inches in diameter, and spread out at top to the width of sixteen or eighteen inches, that a large space may be left round the cullender; this space should reach three or four inches above the uppermost perforations of the cullender, to prevent any of the water from being dashed over the top.

A pit is to be sunk in the ground, not less than six feet deep. In this is to be placed an air-vessel, made of wood, lined with lead, without a bottom, three or four feet in width, and ten or eleven high. The vessel should be supported on feet, of a proper strength, with sufficient spaces between them for the water to pass freely out: this way is preferable to the common one, of placing the lower edge of the vessel on the bottom of the pit, and cutting an aperture in the side, because the height of the aperture is so much taken off from that of the vessel. The reservoir being fourteen feet above the ground, and the upper pipe and cullender reaching down eight feet, only six feet remain below the cullender; so that the air-vessel being sunk six feet in the ground, will reach nearly up to the cullender; and almost the whole height of the undermost pipe will be included within the vessel. This pipe may be above nine feet long, three feet or more of it going down into the pit, which three feet are here an entire gain in the height of the fall; for the pipe, in other machines, comes at most no lower than the level of the ground, where the water runs off on the outside. This height is gained, in virtue of the compressed air in the vessel, pushing down the water below, as already shown: it may be always as great as the height to which the water is intended to rise in the gauge. At the distance of five or six inches, under the orifice of the pipe, is to be placed the concave iron plate or stone, for the water to fall on. In the top of the air-vessel is to be fixed the gauge and the blowing pipe.

Such is the general construction of the blowing machine, which promises to be particularly useful in cases where water is scarce; or where the want of a natural fall renders it necessary to raise, by very expensive means, the great quantities requisite for working the common bellows. It is presumed, that one of these machines will be sufficient for the iron forge, and for sundry other purposes, where the quantity of air is not required to be very great; *that it will be less expensive, on account of the durability of its materials, and the simplicity of its structure, than any kind of bellows now in use; and, what is of principal importance, that much less water will serve for working it.* In cases, where one of the machines cannot supply air enough, as for the large iron smelting furnace, two pipes may be used, both fed by one reservoir, and entering into one air-vessel, as practised in some of the instruments described in the beginning of this article. The use of two pipes appears more eligible than enlarging the bore of one, for air cannot be so freely introduced into a large body of water, though divided by the cullender, as into two smaller ones of equal quantity.

It may be observed, that the blast will be stronger in a dense state of the atmosphere than when it is more rare or expanded, a greater quantity of air being then introduced under an equal volume. If, therefore, the quantity of water has been adjusted so as to raise the gauge to a proper height, when the air was light, it will frequently happen that the same quantity of water shall raise it higher; and consequently, if no greater height is required, that a part of the water may be saved. As the gauge of our machine discovers, by inspection, these variations in its effect, the register affords convenient means of regulating its power, and increasing or diminishing the quantity of water.

(*To be concluded in our next.*)

III.—*An Epitome of the improved Pestalozzian System of Education, as practised by M.* WILLIAM PHIQUEPAL *and Madame* FRETAGEOT, *formerly of Paris, but now at Philadelphia. By* WILLIAM MACLURE, *Esq., President of the American Geological Society*.*

THE great and fundamental principle is, never to attempt to teach children what they do not comprehend, and to teach them in the exact ratio of their understanding it, without omitting one link in the chain of ratiocination, proceeding always from the known to the unknown, from the most easy to the most difficult, practising the most

* From vol. x. of the American Journal of Science and Arts.

extensive and accurate use of all the senses, exercising, improving, and perfecting all the mental and corporeal faculties by quickening combination; accelerating and carefully arranging comparison; judiciously and impartially making deduction; summing up the results free from prejudices, and cautiously avoiding the delusions of imagination, the constant source of ignorance and error.

The means of effectuating the above are, first, a careful examination and inspection of the objects themselves, or of tangible and visible instruments, calculated to demonstrate their properties and bring them within the reach of the senses. If these cannot be obtained, then accurate designs, or representations, and books, and descriptions, although imperfect substitutes, are employed; but these are not to be resorted to until every possible means of acquiring the first two have failed.

They learn mechanism by the machines or exact models of them; arithmetic, by an instrument called the arithmometer; geometry, by an instrument called the trigonometer, and another called the mathemometer, by which the most useful propositions of Euclid are reduced to the comprehension of a child of five or six years old; mathematics, by the help of the last-mentioned instruments; and all the mathematical forms in substance by solid figures. Natural history, in all its branches, is learned by examining the objects in substance, or accurate representations of them, in designs or prints; anatomy, by skeletons, preparations, and wax figures; geography by globes and maps, most of the last of their own construction; and hygiene, or the preservation of health, by their own experience, in attending to the consequences of all the natural functions. They are taught the elements of writing and designing by the freedom of hand, acquired by a constant practice in forming all kinds of figures, with a slate and pencil put into their hands when they first enter the school, on which they draw right lines, dividing them into equal parts, thereby obtaining an accuracy of the eye, which, joined to the constant exercise of judging of the distances of objects and their height, gives them a perfect idea of space, and practises them in a rapid and correct *coup d'œil,* so necessary in the useful arts and manufactures, and on which the accurate knowledge of the properties of every species of matter depends. They learn music by the distinct difference of sounds, through the medium of an organ constructed for the purpose, and a sonometer; and first learn sounds before they are taught the notes or signs of those sounds; gymnastics, or the exercise of all muscular motions, they acquire by the practice of all kinds of movements, always preferring those that may lead to utility, such as marching, climbing, the manual exercise, &c. &c. They are taught the greatest part of those branches at the same time, never fatiguing the mind with more than an hour's attention to the same thing, changing the study, and rendering it a play by variety. The pupils learn as many modern languages as there are different languages spoken by the boys of different nations at school, each instructing the others in the vocabulary of his language, while he acquires the words corresponding in the language of those he converses with, until he has a complete vocabulary in his head, when he begins translating his own language into the foreign; and the master, when he corrects his translation, gives him the rules of grammer by which he is guided in the correction, by which means the pupil learns the practice and theory of grammar at the same time; and while the rule is imprinted on his memory, he has a tolerable idea of the reason and utility of the rule, confirmed by the example in his translation, and supported by the explanation of the master, which avoids the dry, disagreeable, and disgusting study of the theory of grammar, than which nothing can be more irksome, tiresome, and unpleasant to the learner, or more difficult for the schoolmaster, to command attention to; and often renders correction and punishment necessary, to force the pupils to choose the lesser evil.

Education ought to be the apprenticeship of life, and children ought to be taught what imperious necessity may force them to practise when men, always preferring the useful to the ornamental; preparing them to withstand the reverses of fortune, leaving the choice of their amusement and pastime until their pecuniary independence shall permit them to make a choice of their pleasure.

To court pleasure and avoid pain includes the greatest part of the motives of human actions, to accomplish which children ought to be taught to avoid remorse, fear, misery, and ennui. To prevent the first, act always honestly and uprightly; do as you would wish to be done by: secondly, retain all your instinctive courage, and view every thing as it really exists; thirdly, allow a moderate indulgence of the natural appetites, and enjoin a total prohibition against acquiring any artificial tastes or appetites; observe frugality, and the strictest economy in the smallest expenditure, recollecting the old proverb, "take care of the pence, the pounds will take care of themselves:" fourthly, obtain a knowledge of the objects of nature and art, and an early habit of receiving pleasure from the examination of them.

Hume's definition of man, that he is a bundle of habits, is as true as laconic, and points out the advantages that instructors of youth might derive from that propensity, namely, that of acting from habit. By constantly and habitually associating pleasurable sensations with all the useful and necessary operations of life, we thus turn the common occupations which the wants of man require into amusements, and form the life of man into an agreeable pastime. If we examine how the trifling diversions of hunting, fishing, gaming, &c. &c. become pleasures, we shall find the cause to exist in habit and frequent use; which might be more easily attached to some useful employment, the advantages of which would be permanent and lasting, and not finishing when the action was performed, or productive only of remorse and repentance, like nine-tenths of the fashionable amusements. Upon this great and powerful lever of the mind, which as yet has been employed only by crafty politicians, and by that portion of ecclesiastics who have abused religion for their selfish and anti-social purposes, volumes might be written to explain its beneficent connection with all the ramifications of society; but this digression would take us too far from our present purpose.

Two of the best gifts of nature to man are health and time; and perhaps the total neglect and abuse of both may be the cause of most of his miseries and misfortunes, both moral and physical; to rectify which, as far as precept, example, and experience can do it, ought to be one of the principal objects of instruction. This is to be effected by adopting the most effectual means of preserving the one, and making the best possible use of the other, before it is too late; for unfortunately the youth of all countries have squandered the greatest part of both before they have learned their value.

The immense advantage of the energy and exertion springing from free-will, over the cramped and snail-paced progress produced by coercion and force in the government of men, as well as of the animal creation, must be evident to the most superficial observer; but in no case does the evil so materially injure and destroy the best and most valuable interests of society, as in the coercion and punishment of children during their education.

This is the source from which spring all the violent malignant passions of anger, revenge, hatred, &c.; this is the destroyer and exterminator of all their amiable and benevolent sentiments; it is the corrupter of the heart: it stupifies the head, and suppresses all talent and genius, breaks down the spirit of natural independence, and fits men for slaves, by exaggerating their propensity to crime, and annihilating all the fine feelings that lead to great and benevolent actions. All these fatal consequences are avoided by the nature of the system, not requiring any such barbarous means of execution, and rendering the substitution of reason, in place of coercion, both easy and agreeable to master and pupil; their natural curiosity is encouraged and excited, when the gratification of it is a pleasure both to the instructor and learner. Never being forced to do any thing they do not like, all their actions are bottomed on free will, and united with agreeable sensations. Their most complicated studies are but an amusement which increases with the difficulties they encounter; and this concatenation of pleasurable ideas with moral study never ceases, and is the cause of their being at school during their whole lives; and the progress of their knowledge and improvement finishes only in the grave.

The boys learn at least one mechanical art; for instance, to set types and print; and for this purpose there is a printing-press in each school, by the aid of which are published all their elementary books, all of which are constructed upon the contrary principles from those of the old school; viz. taking the most direct and easiest road to arrive at the end proposed, in place of the circuitous metaphysical method adopted by the old system, as if teachers were afraid of giving knowledge too cheap. By setting types they practise accurate spelling, and become familiar with the construction of all the languages which they print, and they can earn their bread in case of necessity. It is also a great source of economy to the school, and answers all the purposes of a recreation from more difficult studies.

The immense advantages of the system are more evident when applied to the great bulk of mankind, namely, the productive, labouring, and useful classes. Those who from conquest, force, fraud, or the industry of their ancestors, are left with a sufficient revenue to live without labour, may remain in a state of ignorance. Perhaps this may be the fact, without injuring materially the state of civilization in the mass of society, as the ignorance of the class spoken of facilitates and accelerates the division of property, a state of things so necessary to general happiness, and to the elevation of mankind to the highest condition of moral and physical perfection. The pupils are capable of obtaining an accuracy of sight, which they acquire by a constant practice of measuring distance and dimensions, which gives them, when they leave the school, an experience equal to the acquirements of many years of instruction of an artisan, as they can, at a glance, decide whether a horse-shoe, a nail, a board, or any other piece of iron, wood, &c., will answer the purpose for which it is intended, without the trouble of trying.

They learn natural philosophy by the most improved and simple instruments; chemistry by the latest and most accurate experiments, never departing from the golden rule of proceeding from the most simple to the most compound, from the easiest to the most difficult, from the known to the unknown, and preferring the useful to the ornamental; making at the same time the application of all the necessary arts and occupations, that their utility may not be lost sight of for a moment.

One of the advantages attached to the system is the facility of forming professors. The popish attribute of infallibility being exploded, the master loses none of his influence with his pupils by acknowledging that he is ignorant of the subject in question, but will learn it along with them, according to system; in accomplishing which he has only to keep one lesson before the class, and the boys have a better chance to learn that particular science or art well, than if the master had been an old professor, for by learning it himself so recently he is instructed in all the difficult places, and is more capable of teaching the children how to get over them, an advantage which the Lancasterian or monitorial system has over the old method.

Lithography being the best, cheapest, and easiest mode of making accurate representations of every thing, and this system requiring so great a number of exact representations, as they are in all possible cases substituted for books or descriptions; the pupils are all taught how to design on the stone or cartoons, and how to make the proper ink and pencils, as well as all the manipulation of printing and working the press, &c. &c.

The advantages of calculating in the common way, of reckoning by cyphers, is the smallest part of the great and beneficial mental improvement gained by the calculation on memory, without the aid of any artificial figures, as it exercises, improves, and accelerates the combinations, and renders comparison easy and accurate; while it accustoms the young mind to rapid deductions, facilitates the drawing of just and accurate consequences, and lays the foundation for a quick, impartial, and logical judgment, in deciding on all questions of intricacy and difficulty, by furnishing to the mind the necessary elements to unravel the most complicated subjects.

The public are now generally informed, that the Pestalozzian system of education has been introduced into this country by the public spirit and liberality of Mr. Maclure.

The following facts, in relation to the actual state of the schools at Philadelphia, were communicated by him in answer to the inquiries of the editor.

EXTRACT OF A LETTER DATED PHILADELPHIA, AUGUST 19, 1825.

Madam Fretageot's school has been established here four years next October, has thirty-two pupils (as many as she can take), and several are waiting for vacancies; she has already completed the education of some, whose parents thought them sufficiently instructed in all useful and necessary information.

M. Phiquepal began his school a few months ago, has eighteen pupils; and will very soon have as many as he wishes to take, as the method requires more constant attention on the part of the instructor than that of the old schools, particularly at first, as the greatest part of the scholars have been treated differently by previous education, and have got habits that must be changed before they can be effectually benefited by the system. It would be necessary, to reap the full advantage of the method, that the children should be sent before they were at any school, except being taught by the mother, who would be aided much by a small book published by Pestalozzi, called the Mother's Manual. I have always thought that children cannot be put too soon to school, and the present practice, commencing in many countries of Europe, seems to sanction it.

I have seen nothing printed about the system except Neef's Sketch, which is all sold, and scarcely a copy is to be obtained in this country, although eighteen volumes have been printed at Stutgard, in Germany, on the Pestalozzian method, which sold so well, that the printer gave Pestalozzi 60,000 francs for his share of the profits. The above epitome is too short, but I like short books with only the outlines; they afford room for reflection, to fill up the vacuum, and stimulate thought, which fixes the subject more firmly in the memory, besides flattering self-love (one of the strongest passions), by authorizing the reader to consider himself as author of all he reads or finds out by his own reflections. The fault I find with a great many books is, that mania of making things too plain, leaving nothing to cogitation, and treating too contemptuously the intellectual faculties of the reader.

IV.—*On the Science of Gymnastics**.

The French government having resolved to encourage the institution of M. Amoros, professor of gymnastics at Paris, the minister of the interior appointed five commissioners to examine in all their parts the gymnastic exercises, and to report thereon in detail. M. Amoros first gave the committee an idea of what he calls elementary exercises, which consist in chaunting different pieces, the rhythm of each of which corresponds with various movements of the legs, arms, and body, which the pupils execute on the spot. A metrometer (metronome) regulates these motions. The pupil thus learns to measure time and space, to regulate with precision the common step, the accelerated step, and the leaps of the gymnastic course. These exercises impress upon their different movements a rhythm which befits them; they give greater developements to the voice, and more force to the lungs; they render the joints more supple, prepare the pupils for fatigue, and dispose them to exercise in the open air. The committee were too enlightened not to appreciate the advantages of chaunting in connection with gymnastic exercises. To accustom the pupils to preserve their equilibrium, so necessary in certain cases of danger, M. Amoros made three of the professors take a ball of 6lbs. and hold it sometimes with the left hand, sometimes with the right, the superior extremity horizontally extended, and advanced in front. The same exercise was repeated with the inferior extremities, the ball being supported alternately by each foot. To sustain the effort, maintain the station, to keep all the moveable points of the body in a fixed position, to subject the extremities to the tarsus, and make the different points of the latter a solid pivot, which maintains the effort and re-establishes the centre of gravity, are the principal muscular actions which this exercise re-

* From vol. x. of the American Journal of Science and Arts.

quire. The pupils in the court and stadium then applied the theoretic principles which they had just learned, and here the committee witnessed the utility of the gymnastic method. They saw with what precision all the various exercises were performed, as well those that required great rapidity of motion, as those that depend on firmness and strength. Many among them obtained 350, 440, and 550 degrees of the free dynamometer, for it is by this instrument that Amoros calculates the progressive developements of their muscular powers.

We have seen feeble and timid men acquire, in a short time, by gymnastic exercises, very considerable strength and boldness, and their moral energy rise in proportion to the increase of their physical strength. From the stadium the pupils proceeded to the inclosure where the machines were erected, and where they performed the exercises of running over inclined planes, clearing barriers, climbing masts, walking upon unstable beams, mounting ladders thirty-six feet high and slipping down, ascending heights by means of ropes and poles, and by men so suspended as to serve as ladders, and descending again with the greatest facility. The commissioners, surprised at the strength, suppleness, agility, and address of the pupils, testified their satisfaction, and acknowledged the utility of the exercises. These were terminated by their vaulting over wooden horses, and also over living ones, and by the conquerors receiving the prizes due to their superior skill.

The design of this instructor is not merely to regulate and perfect the physical powers of his pupils, but to teach and dispose them to lend assistance to the weak, and to aid their fellow-creatures when in danger. Those who first witness these exercises are in constant fear for the safety of the pupils. But their elementary lessons accustom them gradually to measure their force and skill; they are able, by proceeding from simple to compound exercises, to acquire solid instruction. If accidents occur they arise evidently from disobedience, presumption, or forgetfulness of principles so well explained and applied in this establishment. Every needful precaution is taken to secure the pupils from accident. A thick bed of sand is spread at the foot of each machine, nets are extended round the masts, and the less skilful pupils are supported by belts, while their motions are carefully watched and encouraged by the professors. The pupils in this remarkable session evinced the greatest docility.

V.—*On the uses and value of the Chesnut-tree. By* NATHANIEL KENT, *Esq.**

SIR, *Ripon Hall, near Aylsham, Norfolk, Jan.* 16, 1792.

SINCE I have had the honour of becoming a member of the Society for the encouragement of Arts, Manufactures, and Commerce, I have read with great satisfaction Mr. Majendie's judicious remarks upon the Spanish chesnut, in the ninth volume of their transactions, page 17†; and observation and experience have long convinced me that it is the most profitable tree that can be planted. Although the character which he gives of it, has in a great measure anticipated what I had to say in its favour, still I am persuaded a few more particulars relative to it, will not be considered impertinent or ill-timed, though it may in some instances carry the appearance of repetition.

I entirely agree with Mr. Majendie, that, for hop-poles and stakes, it has no equal, in point of durability, and consequently no underwood can be applied to those purposes with equal profit. He seems to think, indeed, that it is not so quick in its growth as ash, upon a moist soil: I think it is not; but, upon a sand or loam, I apprehend it will keep full pace with the ash, and attain sufficient size for

* From vol. X. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

† See page 368 of the present volume.

hop-poles in fourteen years, and be worth at that age two guineas a hundred, and last, with proper care, twenty years; whilst ash, which seldom comes to sufficient size in less than twenty years, will only bear two thirds of the price, and decay in half the time.

For gates and hurdles it is equally good; and being less heavy than oak, is another great recommendation to it; as it is removed from one place to another with greater ease. To these and many other purposes, chesnut, trained and cut as underwood, is peculiarly adapted; and, in point of beauty, no wood surpasses it; as it admits of close planting, runs straight in its branches, and always appears florid and healthy.

I shall next consider the value of the Spanish chesnut for timber, in which (except for the unrivalled purposes of ship building) it will be found for most uses equal to the oak, and in buildings and out-door work much superior.

In 1676, an ancestor of the present Mr. Windham, of Felbrigg, in Norfolk, had the merit of being a considerable planter of chesnut. In the space of fifty years, it is presumed these plantations required thinning, as his successor, about that time, began to apply this timber to useful purposes upon his estate.

The first account is of the branch or limb of a chesnut, about thirteen inches square, which, in the year 1726, was put down as a hanging post for a gate, and carried the gate, without alteration, fifty-two years, when, upon altering the inclosures of the farm where it stood, it was taken up under my direction, and, appearing to be perfectly sound, was put down for a clapping-post in another place.

In 1743, a large barn was built with some of this timber, and is now as sound in every part, beams, principals, and spars, as when first the barn was built: about the same time several chesnut posts and rails were put down, which I have since seen removed: and, after standing thirty or forty years, generally appeared so sound as to admit of being set up in some other place.

The last instance I shall mention, though not of long date, will show the great superiority of this timber over oak in fences. In the year 1772, the present Mr. Windham made a large plantation in his park, which was fenced with posts and rails, converted from young oaks and chesnuts of the same age and scantling, such as were picked out of a place where they stood too thick. Last year, upon Mr. Windham's enlarging this plantation, it was necessary to remove this fence; when the chesnut posts were found as sound as when they were first put down, but the oak were so much wasted just below the surface of the ground, that they could not be used for the same purposes again, without the assistance of a spur to support them.

To these modern proofs of the utility and durability, we may join the authority of Evelyn, an author of established reputation, who asserts, it is good for "mill-timber and water-work, and that great part of our ancient houses in the city of London were built with it, and that it does well for table and other furniture."

As a candid quoter of Evelyn, however, I admit that he says, in another place, that he "cannot celebrate this tree for its sincerity; it being found (contrary to oak) it will make a fair show outwardly, when it is all decayed and rotten within; but that this is in some sort recompensed, for the beams have the property of being somewhat brittle, of crackling, and giving warning of danger."

To account for this drawback in Mr. Evelyn's opinion, it will be proper to observe, that this certainly is the case, with old chesnut, that has been suffered to stand beyond the time of its attaining its full growth: it is then the worst of all timber, being more brittle and more apt to crack, and fly into splinters than any other; but I have never known this to be the case with young chesnut; and therefore in point of economy, it should never be suffered to stand longer than the points of the branches, and the complexion of the bark indicate it to be in a growing or healthy state: which is not very difficult to ascertain by a person accustomed to make observations upon timber. And it is this very circumstance, when properly attended to, that makes this timber more profitable than most others; for it is so early useful, that if it be cut when it squares only six inches, it will be as durable as an oak of six times its size and age. This is in a great measure accounted for by its having so little sap in proportion to other trees, as it will seldom exceed in thickness the breadth of the bark; whereas the sap of an oak will often be from an inch to two inches thick, which is not only useless, but, if suffered to remain, tends very much to the destruction of the timber: in other respects the duration of the chesnut may be accounted for, from its being less affected by worms or insects than any other timber; otherwise it would be impossible that such roofs as King's College, Cambridge, built in the reign of Henry VI. with chesnut, and many other equally ancient buildings, should have lasted so long, and be still in such a perfect state as many of them are.

Therefore, like Mr. Majendie, I earnestly wish to see the culture of this most valuable plant extended over every part of the kingdom, as it must prove highly beneficial to the public.

But let no one be afraid of cutting it too young, for, let this tree be ever so small, if it is large enough for the purpose for which it is wanted, it will be less liable to decay, from its youth; and if underwood be the object, the proverb in beech countries, will be fully verified, "cut wood and have wood."

I am, sir,
Your obedient humble servant,

To Samuel More, *Esq. Sec.* NATHANIEL KENT.

VI.—*On the Culture of Silk in England. By Mr.* SALVATORE BERTEZEN*.

THE promoting the growth of silk-worms, and producing silk in England, has long been an object of the society's attention, and several rewards bestowed, in hopes that, in time, that valuable insect might be naturalized to this climate; and a new branch of manufacture, and in consequence a new employment for women and children found in this country. From the papers of Mrs. Williams†, Miss Rhodes‡, and the Rev. Mr. Swayne,§ little doubts remained of the practicability of breeding and rearing those insects in England. And this year (1790) such indisputable proofs were given to the society by the production of five pounds weight of excellent silk, and a number of the cocoons (which, in the judgment of every one who has examined them, are in general larger, heavier, and of a superior quality to any seen before, and the silk as good as can be produced in any country whatever), that it should now seem, nothing is wanting to the establishment of this *long-wished-for business*, but the planting mulberry-trees for the food of the worms: and this there is reason to hope will be accomplished, several gentlemen in the south-west parts of England proposing to make the trial on the large scale‖. Samples of the silk and some of the cocoons are reserved in the society's collection; and it appeared in evidence to the committee, to whose consideration the business was referred, that silk can be advantageously produced in England, and it was the opinion of the claimant this year (Mr. Salvatore Bertezen), that this climate is better adapted to the breeding of silk-worms than Italy

* From vol. VIII. of the Transactions of the Society of Arts, Manufactures, and Commerce.

† See vol. VII. *Technical Repository*, page 38.

‡ See vol. VII. page 184.

§ See vol. VII. pp. 245, 282, and 363.

‖ This is more especially the case, when a new Silk Company is recently established by Act of Parliament.—EDITOR.

itself! For he believes the great heats of Italy are much more detrimental to the worms than any fogs or moisture of this country.

The five pounds of silk, which was the quantity required to be produced, were obtained from twelve thousand worms; and each thread when wound consisted of seven or nine fibres. Many certificates having been produced corroborating the above, the gold medal was adjudged to Mr. Salvatore Bertezen for silk produced in England.

VII.—*On the Culture of Silk in England. By the Rev.* GEORGE SWAYNE*.

SIR, *Pucklechurch, near Bristol, March* 25, 1791.

I BEG leave to address you once more on the subject of silk-worms; not that I have the result of much additional experience in breeding them to offer you, but chiefly to prevent discouragement in the undertaking, which I think not unlikely to arise, from a circumstance attending the experiment of Mr. Bertezen, of which an account is given in the VIIIth volume of these transactions. It had gone abroad, and, I believe, was not discountenanced by Mr. Bertezen, that he was possessed of a very extraordinary and superior breed of worms, as well as a secret art of managing them: the former he refused to impart†, and likewise to disclose the latter. The account in the VIIIth volume, that he obtained the five pounds of silk, for which he claimed the society's premium, from twelve thousand worms, compared with the calculations of Miss Rhodes, in a former volume, that thirty thousand would be necessary to produce that quantity, seems to confirm the fact of his having a very superior breed of worms. And as he has

* From vol. X. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

† A friend of mine applied to him for a few eggs, and offered him his price, but could not obtain a single grain.

now, I presume, left this country, and taken his breed and his secret with him, some will be ready to object that, if there be a doubt whether so superior a breed would have succeeded in this climate, much less is there any probability that any inferior breeds, particularly such very inferior ones, it will be taken for granted, as we are at present in possession of, will be attended with success.

The difference between Miss Rhodes's calculation and the statement given by Mr. Bertezen's actual produce, is, in appearance, amazingly great; but perhaps it may be greater in appearance than in reality. As silk is sold by troy weight, Mr. Bertezen's pound was probably no more than twelve ounces. Miss Rhodes very evidently calculated by avoirdupois weight: had Miss Rhodes's been adjusted by the former weight, the number of cocoons, for five pounds of silk, had been twenty-one thousand six hundred. Still the difference is very considerable. Mrs. Williams in her letter has mentioned two hundred and forty-four cocoons producing nearly an ounce and a half: a calculation, by this rule, extended to five pounds troy weight, would give fourteen thousand six hundred and forty. But Miss Rhodes supposes that Mrs. Williams includes the whole of the waste silk, as well as that reeled off. I do not see any reason for such a supposition. I last year bred fewer than one hundred worms (merely for the sake of experiments and continuing the breed), and suffered them all to perforate their cocoons. Only fifty of these could be wound off, which was done in the method described in a former letter. The reeled silk produced from these fifty cocoons weighed exactly one hundred grains: if from this we calculate the number sufficient for five pounds troy, we shall have fifteen thousand five hundred and fifty. As these were wound off dry, so much of the silk could not be taken off from them as is generally done when reeled in hot weather, where oftentimes nearly the whole of the silk is reeled. The silk which remained on those fifty cocoons, after reeling, weighed thirty-three grains. If we only allow half of this weight to be added to that reeled off, it will reduce the number necessary for five pounds, to thirteen thousand four hundred and five. Here the difference, when compared with Mr. Bertezen's, is not very considerable.

But it is possible that Mr. Bertezen's silk might have been weighed by avoirdupois weight; in which case I am inclined to think, as the round number twelve thousand is given, that he might have calculated, without any actual enumeration, according to a rule mentioned in the pamphlet which he published on the subject of silk-worms, by allowing one hundred and fifty cocoons, of the average weight of five grains, to produce one ounce of organzine, which, at sixteen ounces to the pound, gives exactly twelve thousand for five pounds. The passage which contains this rule I beg leave to transcribe from Mr. Bertezen's book.—"These cones," meaning those which he obtained from worms bred in England, the year before he published his account, "weighed, after the gathering, six grains each: some weighed five, and the weakest four, though the worms were not of the first class. It is easy to calculate that, in order to have one ounce of organzine from such cones, one with another, one hundred and fifty may be sufficient." In this account I do not understand the meaning of the expression, *after the gathering.* On the first reading it should seem to mean immediately after the gathering or collecting them from the broom, heath, or other twigs they were spun in; but this cannot be the intention, as, in this case, with the crysalids included, they must have weighed a vast deal more: neither can it mean after the crysalids were killed and become dry, as, even in this case, they must have weighed considerably more, since the dried crysalids, even of the common breeds, weigh on an average four grains: it must therefore mean the whole silk produced by the worm, without any insect included in it; and, if this is the proper interpretation, the weight is very extraordinary indeed. In those cocoons, which I have examined, the reeling silk has, on an average, amounted to about two grains and a quarter from each: the dried crysalis has weighed about double the reeling silk, and the reeling silk has been rather more than double the waste silk.

Mr. Pullein, in his essay on the culture of silk, which is by much the best treatise I have met with on the subject, and which I have but lately had an opportunity of consulting, tells us, that "three thousand three hundred silk pods, with the crysalids in them (that is, alive or unbaked) weigh about twelve pounds; these twelve pounds will make about sixteen ounces of reeled silk, besides about eight ounces of flos." This gives of reeling silk to each cocoon two grains and one third. In a paper containing an account of the management of silk-worms, published in the second volume of the American Philosophical Transactions, communicated to Dr. Morgan of Philadelphia, from Messrs. Hare and Skinner, of London, and said to be obtained from one of the first houses in Italy, we are told that one hundred and fifty ounces of good cocoons yield about eleven ounces of silk, from five or six cocoons: if you wind coarser, something more. This I calculate to give no more than two grains and one twentieth to each; whereas Mr. Bertezen's worms produced on an average, three grains and one fiftieth, although the worms, he tells us, were not of the first class.

I have been told by a person who saw them, that Mr. Bertezen's worms and cocoons were amazingly large, and that he even showed one cocoon very little inferior in size to a common hen's egg.

It is not, however, always the consequence that the larger the cocoon the more valuable; since we have it from respectable authority (the paper just mentioned in the American Philosophical Transactions), that the good cocoons are those which are brought to perfection strong and little; that the cocoons of the mountains are better than those of the plain; it is true they are not so large as those of the plain, but the worm is proportionably less." If, therefore, this extraordinary large breed is not to be come at, we surely ought to be contented with possessing, and the possibility of possessing such breeds as we know will produce, in this country, as large a quantity of silk as is, on an average, produced by silk-worms in the best silk country in Europe. There is likewise another reflection from which we may draw some consolation, that the larger the worm, the more food must it proportionably devour. With regard to the importation of foreign breeds, it is the opinion of Mr. Pullein, "that neither animals nor plants, when transported from one climate to another of a different temperature, are immediately naturalized; that there is some time required, and often some succession of generations, before their nerves and fibres can adapt themselves to the different influence of the air and sun." The consequence he draws from hence is, that it cannot be expected by us that silk-worms, bred from eggs, imported recently from Italy or France, can immediately thrive: those therefore who attempt the breeding of silk-worms in England had better raise their stock from eggs, which have, from some preceding generations, had their originals among us. This opinion, it will be said, Mr. Bertezen's very successful experiment effectually contradicts; but Mr. Bertezen's experiment does not apply in this case, as, if I am not mistaken, he made use of artificial heat.

As an instance to confirm the above reasoning of Mr. Pullein, I might mention, that the worms produced from those eggs you was kind enough to favour me with, obtained from Turin, proved much more tender and delicate than the breed I was before possessed of; nor was the silk they spun nearly so strong as that spun by the latter. However, it is but just to say, that the Turin worms appeared to be a variety quite distinct from the others; their eggs, when first received, were smaller, and continue to be so in succession: the worms are not so large, and have some peculiar marks on them. The cocoons they spun were mostly white, or flesh-coloured, of a different and irregular shape, some of them almost globular: the thread of the cocoon seemed smaller and more delicate, and was more firmly stuck together with the natural gluten, so that it could not be reeled off but in very hot water. One peculiarity attending the Turin worms was, that they refused lettuce leaves, and chose rather to die than to taste them.

In a former letter I informed you that I procured a quantity of mulberry seed, with an intention of raising a nursery of young trees from it. This was sown in the month of April, 1789, the largest part of it, and the best seed, on a bed of dung, which was intended for a slight hot-bed; but the dung being very stale, and having fermented before, did not heat at all, at least not perceptibly: the remainder was sown on a border, under a south-wall. The seed on the dung-bed vegetated rather earlier than the other, and grew very well during the summer, many of the plants rising six inches in height. With a view to prevent the ill effects of the frost, the bed was covered, at the approach of winter, with a coating of moss, which had been immersed in scalding water; this I thought necessary to kill the eggs and larva of insects, as well as the seeds of weeds which it might contain: this precaution, however, with respect to frost, was entirely useless, as the winter proved so exceedingly mild. In the spring I counted upwards of three thousand apparently healthy plants. In the latter part of the succeeding summer, they were attacked with a disease which showed itself in putrid spots on the leaves, which by degrees rotted off: on examining these plants in the autumn, when about to transplant them, they were almost all of them found to be cankered off just at the surface of the ground. What was the cause of this disorder I cannot with certainty pronounce; but am inclined to impute it, jointly to the wetness of the season, and the roots of the plants striking into the dung: those which were sown on the common earth, in the south border, were not so much affected by this disease; yet some of them were killed by it. The summer of 1789, as well as the last, was so unfavourable to the ripening of mulberries, that I could get no good seed. I still hope that some effectual method will be found out of raising them from cuttings; but, however that may be, we may be assured that, as soon as there is a demand, mulberry-trees will be multiplied by some means or other. This is not barely my opinion, but the opinion of a person much better worth listening to. "It is demonstrable," says the excellent Evelyn, "that mulberries, in four or five years, may be made to spread all over this land; and, when the indigent young daughters in proud families are as willing to gain three or four shillings a day by gathering silk, and busying themselves in this sweet and easy employment, as some do to get four-pence a day for hard work at hemp, flax, and wool, the reputation of mulberries will spread in England." The misfortune is, we are uncertain which kind of mulberry-trees, whether the white or the black, we ought particularly attend to the propagation of; the sentiments of writers on this subject, and the practice of the different silk countries, according to the accounts given us by travellers, are so exceedingly various. It is curious to compare a few of them. From Du Halde we gather, that the white mulberry is chiefly used in China: Mr. Swinburne tells us, that, in Calabria, the red sort, I suppose he means the black, is invariably the food they make use of; and that it is preferred by them to the white sort for several reasons which he mentions; although he informs us in the same page, that he believes it to be the effect of prejudice, as the Chinese, Piedmontese, and Languedocians, prefer the white sort. In his travels through Spain, the same author tells us, that, in Valencia, the trees are all of the white kind. In Grenada, where the best silk is produced, they are all black. Mr. Hanway, in his account of his travels in Persia, mentions a shrub mulberry*, which, being annually pruned, produces the most proper leaves for the silk-worms: he does not say whether the mulberry-trees in that country were in general the black or the white fruited; yet he mentions being treated, at Astrabad, on the 17th May, with large white mulberries, at an entertainment, which, he says, are a delicious fruit. From hence we are certain that they have the white mulberry in Persia. Mr. Pullein tells us, that the black mulberry leaves are said to be made use of in Persia for rearing silk-worms; yet he seems rather inclined to prefer the white. Barham and Evelyn are decidedly for the white. Mr. Young writes me, that "it is very singular that the black mulberries are never used, I believe. I have seen noble trees of that sort, in Provence and in Piedmont, but never stripped, having been planted merely for the fruit: I made many inquiries, and was told that the silk was good for nothing. If the leaves would do, those trees would pay from one to two louis-d'or each per annum; yet no use is made of them." Mr. Bertezen allows, "that, in Italy and France, they make use of the white mulberry leaf; despising the black so much, that, in some parts, it is considered as poison to silk-worms;" yet he assures us "that he himself by all means prefers the black," and gives his reasons for that preference: he adds, however, "that in well-regulated nurseries abroad, on account of the advantages of the two kinds of mulberry leaves, they are both employed." Had not Mr. Bertezen given this information, I should have imagined that it could seldom happen that both kinds should be used in the same nursery with advantage.

The black mulberry leaf is evidently much more succulent than the white; and therefore I should be ready to conclude, that a change at any time, from the white to the black, would be very likely to cause the worms to burst;

* Is not this the species of mulberry lately introduced into this kingdom by Mr. Nouailles?

chiefly from its containing more substance. I once gave my sentiments in favour of the black mulberry leaf: since that time I have observed that the white has seemed more agreeable to the worms, and that they have seemed to thrive best with that food. In order to have the most agreeable and wholesome food for the worms, it is, I presume, necessary that the trees which produce that food, should be in the most thriving state; for the trees to flourish, they must grow on such soil as is well suited to their nature: this congeniality of soil may be different for the different kinds of mulberry. From what I have observed, the white seems to prosper in a moister and stiffer soil than the black would: it should seem, therefore, that we should be directed in our choice of the sort to be planted, by the soil we have to plant in. If our soil is dry, sandy, or gravelly, we should make choice of the black; if it be a rich loamy, and somewhat moist soil, we should choose the white. A stiff clay, and a soil that is very wet, is unfit for either; but the surest way would be to try both, and to multiply that sort which throve best.

I am, sir,

Your and the society's humble servant,

To Samuel More, *Esq. Sec.* G. Swayne.

P.S. Are there yet those who object the unfitness of the climate to the scheme of raising silk in this country? What would they say, were they to read the underwritten communication from a gentleman of credit on the continent, to a celebrated agriculturist?

"Not less than five thousand four hundred pounds weight of silk has been raised last year (1789), in the cold, mostly sandy, territories of Prussia." What could not be raised in the milder regions of Great Britain and Ireland, under equal encouragement; a product which employs but six weeks of the agriculturist and labourer's work!

VIII.—*On an improved mode of laying Water upon Pitch-back, or Back-shut Water-wheels. Invented by* JACOB PERKINS *Esq. Engineer, London; and communicated by him to the* EDITOR.

WITH A PLATE.

OUR readers may possibly be acquainted with a method of laying water upon water-wheels, published by a Mr. Hughes of Manchester, viz., by means of a leather flap, the breadth of the wheel, supported on horizontal bars, or a grating at the end of the pentrough, near the top of the wheel; and which leather could be rolled up or unrolled by machinery connected with a centrifugal governor, so as to keep a due supply of water on the wheel, according to the work to be performed by it. This leather, however, we should conceive, cannot be very durable, and must require frequent renewal.

Mr. Perkins accomplishes a similar object, but by means greatly superior. In Plate II. fig. 1, the penstock *b*, is shown as terminating in a circular end, corresponding with the curvature of the water-wheel: across this end an opening, or gap, *c c*, is made. Upon the circular surfaces above and below this opening, a cast-iron circular plate, *d d*, is fitted, having a recurved mouth *e*, in it, extending nearly across it, to suffer the water to pass through and to guide it in the direction of the lips, or risers of the buckets in the wheel. To the circular plate, *d d*, two circular toothed racks, one of which is shown at *f*, are fitted one on each side; these are acted upon by two pinions, one of which is shown at *g*, both being mounted upon one axis. A lever, *h*, is here shown as united with the axis of the pinions, by means of which, and a staff connected with it, the supply of water to the wheel may be regulated by hand: but in fact, it was acted upon by means of a centrifugal governor, similar to that of a steam-engine, which was connected with it, and by which the equable motion of the machinery was maintained. A stop-gate, *i*, was fixed across the penstock, to shut down when the mill was to be stopped, or in case of sudden flushes of water. The water in the penstock was, however, usually maintained at an uniform height, and it flowed over the lower edge of the mouth, *e*, in the plate, *d d*, into the buckets of the wheel, which were intended to retain it, till it had reached below the axis of the wheel, and on falling out it again acted on the lower part of it, in the manner of an undershot wheel.

IX.—*On freeing Water-wheels from Back-water in times of Floods.* By JACOB PERKINS, *Esq., Engineer**.

SIR, *London, March* 8, 1820.

I REQUEST you will have the goodness to lay before the Society of Arts, &c. the following communication relative to a method, invented by me, of drawing off the back water, from water-wheels.

This improvement in mills consists in using part of the superabundant water, in times of floods or *freshets*, to free the water-wheels from the back-water occasioned by such floods. To effect this purpose, the following plans have been adopted: In plate II. fig. 1 is an elevation or section of a water-wheel, shewing the application of the system of forcing off the back-water which accumulates in times of floods. A, represents a water-tight tube or trunk, being made equal to the breadth of the wheel, and the depth of its buckets; and running from the bottom of the penstock, to, or past the centre of the bottom of the wheel, B, is a receiving tube or trunk, being one-third larger than the small end of the tube A, and is also in a direct line with it. E is an opening between the tubes

* From vol. XXXVIII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its silver Vulcan medal to Mr. Perkins, for this invention.

A and B; through this opening the back-water, (which had accumulated under the wheel, while the current was cut off by the gate *a*), is carried off by the lateral velocity of the current, which rushes from the tubes A and B. C represents the back-water; D the bulk-head.

It will be readily seen, that by opening the gate *a*, the water will rush down the tube A, and join the back-water at E; and with it pass off through the tube B, under the bulk-head D. The water expended in turning the water-wheel will also be carried off by the same current, through the tube B.

This method I recommend where it can be adopted in the erection of new works; but for those already constructed, I would bring a similar tube with an opening in it, running at right angles to the water-wheel, and which may either be supplied with water, by a curved channel, from the dam or reservoir; or otherwise, as may suit the situations of the wheels.

I am, Sir,
&c. &c. &c.

A. AIKIN, *Esq. Secretary, &c.* JACOB PERKINS.

X.—*On an Apparatus for making Lacquer for Brass, without the employment of Heat. Invented by Mr.* JOHN CALLAHAN, *Lamp-manufacturer, Gas-fitter, &c., Exeter-street, Strand.*

WITH A FIGURE.

MR. CALLAHAN, to whom our readers are already indebted for a description of his valuable brass-founder's forge-hearth and steam-boiler*, has favoured the Editor with a sight of the very simple and useful apparatus, which he has contrived for the above purpose; and which we think is not only exceedingly well adapted to that use but may also serve equally well for making spiritous tinctures in general.

* See vol. VIII. page 149.

He employs a two gallon bottle, A, see Plate II. fig. 2, into the neck of which, previously making it rough with a file, he cements a brass tube, B, by means of Plaster of Paris. This tube has a female screw within it, into which can be screwed either a solid brass stopple, similar in form to the common glass-stopples; or else a double wayed stop-cock, C, the plug of which, D, has two rectangular channels made in it, the one opening upwards, and the other downwards. These channels, when the plug is turned into the position shewn, communicate with two straight channels made through the solid part of the stop-cock, from the plug-hole to the inner end of it: but when the plug is turned half-way round, or in the contrary direction, it closes both passages. The stopple and the cock are rendered water tight, by a collar of leather being interposed between the shoulder and the end of the brass tube, when screwed together, and the plug is secured in its place by a screwed nut, and a washer.

The bottle, A, is laid on its side, and supported within a wooden rectangular frame, E, united by two hinges with the wooden base F. The frame E, is made narrower than the diameter of the bottle A, and which consequently rests upon its upper edges. This frame, with the bottle in it, can be raised or elevated at its other end, and be supported at any required height by the rack G, which is hinged to the basis F at its lower end; and the rack itself is prevented from moving sideways, by a springing wire staple, H, which is driven into the end of the frame E; leaving room, however, for the rack to be released from its contact with the end of the frame, when necessary to lower it, by taking hold of the upper end of the rack.

About a gallon and a half of the most concentrated alcohol or spirit of wine is put into the bottle, with the proper quantity of seed-lac, and the colouring materials to form the lacquer; the brass stopple is then firmly screwed into its place, the collar of leather being first interposed, and the whole contents of the bottle beng well shaken up, the bottle is laid on its side in the frame. The next and succeeding day, it is again shaken up once a day, and laid upon its side. By this time, according to the warmth of the season, the spirit will have acted more or less, upon the lac, and other materials: but if not sufficiently, the agitation must be repeated for other successive days, in the same manner, until it is found to be sufficiently impregnated. The bottle is then removed from the frame and set upright, when the brass stopple must be unscrewed, and the stop-cock be substituted in its place. One of the straight channels in the solid part of the stop-cock, C, must have a bent tube, I, fitted into it, and secured with soft solder. This channel and tube is for the purpose of admitting the atmospheric air to enter the bottle; and therefore the bottle must be laid or placed so in the frame, that the inner end of the tube I, shall be elevated above the surface of the liquid contained in the bottle. In this position, the bottle and its contents must be suffered to remain at rest a day or two, or until it appears on looking through the fluid sideways, that a sufficient quantity of clear lacquer is formed above the materials to be worth drawing off. The cock being then opened, the air enters the bottle, through the uppermost of the two channels in the stop-cock, exactly in proportion as the lacquer is gently drawn off through the lower channel; when, however, the slightest cloudiness appears in the flowing liquid, the cock must be instantly shut, and the whole be again suffered to repose, until on inspection, another quantity of the clear lacquer is separated, which may also be drawn off as before; and when no more will come away, whilst the bottle lies in its horizontal position, the end of the frame opposite to the hinges may be raised, and be supported on one of the teeth in the rack, as shewn by the dotted lines in the figure; the liquid is then again to be left to subside, and when enough is seen to have become clear, it may be drawn off, and the frame be elevated more; and so on, till all is so drawn off. More alcohol may now be added, and shook up with the other ingredients; the stopple having however been previously substituted for the stop-cock; and the process may be thus continued as above directed, as long as any thing can be extracted and drawn off. Finally the drugs may be filtered through blotting paper, supported in a glass funnel as usual.

In this way, and without incurring the hazard of employing heat, Mr. Callahan succeeds in forming an excellent lacquer for his brass-work.

XI.—*On the Choice and Management of a Razor.* By *Mr.* E. Rhodes, *of Sheffield, Cutler.*

In our seventh volume, page 47, we gave an article "*On the hardening and tempering of Steel,*" from an essay by Mr. Rhodes, "*On the Manufacture, Choice, and Management of a Razor.*" We now resume our extracts from that work.

"It is certainly of some importance, that what a man is under the necessity of doing *daily* should be done *well*, and *with as little inconvenience as possible*. Shaving with a *bad*, or even an *indifferent razor*, may properly be regarded as *one of the miseries of human life*. It is an operation which men rather submit to than solicit: it is occasionally attended with pain, and as it cannot be avoided, it is at any rate desirable to lessen its unpleasantness. Hence every *novelty* in the form and make of a *razor*, or even of a *strop*, have hitherto been caught at with some degree of avidity; the delusions have had their day, and in all probability answered the purposes for which they were created.

"A few remarks on the *weight* and *form* of a razor will suffice, its primary excellence consisting in qualities of another description; namely, in its regularity and fitness of *concavity*, its *hardness*, and the *durability* of its edge. Weight and form are, notwithstanding, of some importance, and entitled to particular attention. The length of a razor, which generally varies from four to five inches, if manufactured on regularly established principles, determines its relative weight. It is essential that the thickness of the back of the blade should bear a correspondent proportion to its breadth, which, generally speaking, should be as one to three and a half, though indeed this proportion may be permitted to vary a little; it should, however, be understood, that the farther it is departed from the more unserviceable does the razor become; the reason is obvious: a razor is honed, or whetted, by resting equally upon the back and the edge; if, therefore, this operation be performed upon a narrow blade, with a disproportionately strong back, a short and thick edge is produced, not any way calculated to serve the purposes of shaving with advantage. If, on the other hand, the blade be broad, and the back light, it is impossible to avoid forming a long and thin edge, which cannot be sustained for a moment against the opposition of a strong beard. It is therefore evident, that justness of proportion, with respect to breadth and thickness, is more to be attended to than length; this latter, indeed, is so entirely and completely matter of choice, that any observations upon it would be obviously superfluous. The strength or thickness, and of consequence the weight of what workmen term the *tang*, or the finger-hold of the blade, is likewise a circumstance worthy of notice. A requisite proportion should here be preserved, otherwise the utility of the best manufactured razor may be considerably diminished: if thick and heavy, the weight of the cutting part of the blade is so much reduced, that great pressure is required to make it bear upon its work; if thin and light, similar to the razors manufactured in France, it cannot be held firm in the hand; each extreme should therefore be avoided: undue strength or weight in the handle may likewise produce the former of these effects.

"A question here naturally arises: how are the defects above alluded to to be detected, by persons unaccustomed to the manufacturing of razors? If the eye, which almost instantly observes any thing approaching to disproportion in the parts, should in this instance be an insufficient guide, let the *hand* be resorted to; it may here prove a more competent detector. Thus, before a razor is purchased, let it be tried, in the same position in which it is held during the operation of shaving; if *thin* in the tang, it will soon be discovered that it cannot be maintained in a cutting direction, without a much stronger and firmer grasp than ought to be employed on so delicate an occasion; if *thick* and *heavy*, though it may be held more easily and pleasantly, yet it cannot fail to be observed, that the cutting part of the blade will be so much over-balanced by the weight of the hand-hold, that here again, though from a completely opposite cause, considerable exertion will be necessary to apply the razor with suitable effect.

"Sensible of the advantage of a firm, and at the same time any easy hold of a razor, some cutlers have recommended that the sides at least, if not the whole of the tang, should be cut in the manner of a file; this rather detracts from the elegance and the high finish of the article, but its utility cannot be doubted.

"Form is of equal consequence with weight, and not by any means so dependent upon fancy as is generally supposed; one form, at least, has decidedly the advantage of another.

"Inequality of breadth, which necessarily includes a proportionate inequality of thickness in the back, is, however, liable to objections, that arise chiefly from the additional portion of care required in the course of manufacturing, and more particularly in the very critical process of hardening the razor; for in communicating a requisite degree of heat to the thicker parts of the blade, the thinner are frequently so much over-heated that the whole razor is injured beyond remedy, and its utility effectually destroyed. It must be acknowledged, that the occurrence of this formidable evil may be prevented, but only by the exercise of more care and caution than are generally used.

" A straight-edged razor is by no means adapted for general use. It is, in fact, fitted only for those who, convinced that every cutting instrument, from a saw to a razor, is composed of a regular succession of teeth, or points, nearer or farther apart, have learned to distinguish between the operation of cutting, and what may not inaptly be denominated *scraping*. The latter is, however, the prevailing mode of shaving; it is the practice, in a greater or lesser degree, of almost every man who shaves himself; and as it is an evil which cannot entirely be removed, it must be partially provided against. How far this is within the power of the razor-maker, will perhaps appear from the following remarks. It may here be laid down as a principle, that whatever the form of the back of a razor may be, the edge should always describe a portion of a circle.

" It must be tolerably evident to every man who thinks upon the subject, and who has paid attention to the manner in which a razor is commonly used, that the *circularly curved blade* here recommended, even if applied in the very injudicious mode above alluded to, has decidedly the advantage, whether passed over the face obliquely from the point to the heel, or drawn forwards without the least obliquity of direction, that it must of necessity cut, even where a *straight-edged razor* would do nothing but fret or tear the skin, without removing the beard.

" After all it must be admitted, that the advantage which a full-edged razor has over a straight one, in point of cutting, arises chiefly from a very defective manner of shaving: so long, however, as this defect exists, so long will the full-edged razor claim a decided superiority. It often happens, that men groaning under this very useful and necessary operation, attribute their bleeding, writhing, and contortions of face, to the badness of the razor, when the principal fault is in themselves.

"*Scraping* is not precisely the same thing as *cutting*; and if, contrary to all good advice, a man will apply the whole edge of a razor to a part of his face, and draw it in a straight line downwards, as a butcher scrapes the bristles from the back of a hog, instead of giving it, at all times, an oblique and cutting direction, he will often find himself in an unpleasant situation, and all the abuse he can pour upon the instrument in his hand will not furnish an effectual relief.

"*Form, weight,* and *justness of proportion,* united with a proper degree of *hardness,* are certainly constituent parts of a *good razor;* yet its excellence depends likewise on its possessing a *regularity* and *fitness* of *concavity.* It is already almost generally known, that this regularity is produced in the process of grinding, by the use of stones of different diameters, varying from *four* to *twelve* inches, according to the price of the article required; and it cannot have escaped observation, that this circumstance only constitutes a very essential difference of edge.

"The grinding of razor blades on a *four* inch stone has recently so much prevailed, that a few remarks on its superior pretensions may be admitted with propriety. It is easily discernible, that a razor thus manufactured must, of necessity, possess great thinness of edge; a circumstance which, independent of any other, renders it unfit for general purposes, even though it may be used in some cases with advantage: a strong wiry beard will put all its boasted excellence to the proof: here it will be found, that a less degree of concavity, and of consequence a stronger and firmer edge, is indispensably necessary. From the observations here adduced, it appears that the concavity of the blade should at all times be regulated by the formidableness or otherwise of the object it has to encounter. Razors, however, ground upon stones of about *six* or *seven* inches diameter, may be recommended, as best adapted for general use; they are sufficiently hollowed, or ground out, for any service, however hard, to which they may be applied; and they combine a desirable strength and firmness of edge, with a requisite degree of thinness, provided that the strength of the back, and the breadth of the blade, are duly proportioned.

"The *concavity* of a razor should likewise possess great evenness and regularity, otherwise a very unequal edge is produced, a defect which every application of the hone will rather increase than diminish, and which nothing but re-grinding in a more perfect manner can possibly remove. There is an appearance produced upon the blade of a new razor, by the use of the hone, which affords a certain criterion by which this formidable imperfection may always be detected. Two lines are produced, the one upon the edge, and the other upon that part of the back which rests upon the hone in whetting. On examining a razor, these lines are very apparent, and are easily distinguished by their difference of polish; in some razors they are very unequal, and present several variations in breadth, from heel to point; others possess an even, undeviating regularity; these different appearances should be noted with particular attention, as they afford a certain means by which the most superficial observer may learn to detect defective workmanship in is *one* of the requisites of a good razor. It can hardly be necessary to add, that where this *evenness of line* exists, a *regularity of concavity* cannot possibly be wanting; nor where the contrary is the case can a good cutting edge be expected.

"After all that has been said, it must be admitted, that no infallible criterion can be established, by which all the defects that a razor may have can with certainty be detected. Some, indeed, are exposed to observation; others are hidden, and evade it.

"Razors were, in some respects, as well manufactured many years ago as they are at present: it was indeed, at one time, a principal object *to make razors for use.* Latterly *they are made to sell, without any other consideration whatever!* Neither the quality of the material used, nor the excellence of workmanship, appear to be at all studied! A cheap and useless instrument is too frequently foisted upon the public; and the reputation of Sheffield manufactured cutlery is grossly injured by the practice! Yet, amongst the mass of indifferent cutlery now made in this ancient mart for hardware, many of its best articles are of the first quality, and equal, if not superior, to any in the world.

"Some new and important improvements in steel have lately been attempted, which, if ultimately successful, will be of considerable advantage to the manufacturers of razors, and every description of fine cutlery. Messrs. Stodart, F. R. S.* and Mr. M. Faraday, chemical assistant in the Royal Institution, have made an interesting communication to the Royal Society of London, in which they detail a series of experiments, undertaken for the purpose of ascertaining how far the best refined steel may be improved by an alloy of other metals. Some of these experiments appear to have been very successful in their results, and may, probably, at no very distant period, prove of essential service to the town of Sheffield. The application of chemical knowledge to the improvement of the best refined steel, can hardly fail to be attended with beneficial consequences; this beautiful and highly useful metal has been refined to a degree of purity and excellence, of which it was at one time thought utterly incapable; and let no one suppose that it has attained the

* Lately deceased.

maximum of improvement; such a conclusion would be not only extremely unphilosophical, but injurious and absurd. The public are therefore indebted to those men who, by patient and laborious investigation, discover the hidden properties, detect the chemical affinities of matter, and apply the secrets of nature to the useful purposes of life. Messrs. Stodart and Faraday pursued their inquiries patiently, under a number of discouraging circumstances and unsatisfactory results. The combinations they anticipated did not always take place; but they finally ascertained the exact proportions necessary to produce complete and perfect alloys of steel with silver, platina, &c. The former of these combinations, they say, produces a metal 'harder than the best cast-steel, or even than the Indian wootz; and the articles made of it prove to be of a very superior quality.' They add, 'the silver alloy may be advantageously used for almost every purpose for which good steel is required.'

"Anxious to ascertain to what extent steel might be improved by the alloy of silver, as recommended by Messrs. Stodart and Faraday, I have undertaken a similar series of experiments, the results of which have all tended to establish the importance of their researches, and the accuracy of their conclusions. My next object was, to bring this improved steel into use, and establish its superiority by the excellence of the articles to which it was applied. I have now, for nearly twelve months, used this improved steel in my manufactory, and hitherto the razors into which it has been wrought have invariably proved decidedly superior, for fineness and durability of edge, to any article previously introduced into the cutlery manufacture in any part of the kingdom.

On the Honing and Stropping of a Razor.

"Let the hone* be seldom, and but sparingly resorted

* The *iron-stone hone* though but very little used, imparts the finest edge to a razor. This *iron-stone hone* is found in those iron and coal mines

to; and never, unless by frequent and repeated stropping, the *edge* of the razor is entirely destroyed: use the best pale oil, and be careful to preserve the hone clean and free from dust. Previously to the operation of shaving, it will be found of service, particularly to those who have a strong beard, and a tender skin, to wash the face well well with soap and water; and the more time is spent in lathering and moistening the beard, the easier will the process of shaving become. Dip the razor in hot water before applying it to the face; use the blade nearly flat, always taking care to give it a *cutting* instead of a *scraping* direction. Strop the razor immediately after using it, for the purpose of effectually removing any moisture that may remain upon the edge; and be careful not to employ a *common strop*, as the composition with which they are covered, is invariably of a very inferior quality, and injurious to a razor. The strop should always of the best manufacture, and when the composition is worn off, it will be found particularly useful to rub it over lightly with a little clean tallow, and then put upon it the top part of the snuff of a candle, which being a fine powder, will admirably supply the place of the best composition ever used for the purpose. Another excellent mode of renovating a razor-strop, is by rubbing it well with pewter, and impregnating the leather with the finest metallic particles.

"In closing these observations, I cannot omit to protest against *the elastic cushion strop*, which, from easily yielding to the pressure of the razor, removes the *fine, keen, flat edge* produced by the hone, and substitutes *an injurious roundness* in its place. A flat strop, not too much burthened with leather, is best adapted to continue the form which the edge receives in honing; to admit of any other, is to subvert in practice the principles on which a good cutting edge is formed."

that had taken fire, and has been termed *artificial jasper*. They may be had of various degrees of coarseness and fineness.—EDITOR.

XII.—*On an Improved Drill for Whalebone.*

WITH FIGURES.

UMBRELLA makers and others, who have had occasion to drill whalebone, must have frequently experienced the difficulty of withdrawing their drills, after forming the holes, on account of the opposition they meet with from their having to make their way through, the whalebone dust remaining in, and clogging up the holes.

In order to remedy this evil, an ingenious umbrella maker of our acquaintance has recently formed his drills with cutting edges on the sides of their stems, as well as on their ends; so that they now *bore* their way out of the holes with great facility.

This will be understood by a reference to plate II. in which fig. 3 is a drill of about the size of those usually employed; but, in order to render our explanation clearer, we have shown it as being greatly enlarged in fig. 4. Fig. 5 is a section of the stem, with its cutting edges taken at the dotted line in fig. 4.

This drill is employed in a lathe of an ingenious construction, it being fitted up expressly for drilling the ribs, &c.; forming slits in the staffs by means of small circular saws, and rasping the ends of the ribs taper, so as to fit the tips or conical ferrils. We may, probably, hereafter furnish our readers with a dsscription of this useful lathe, the umbrella trade having now become one of first-rate importance.

It has been suggested to us by an intelligent friend, that a drill of the above improved construction is not only desirable for perforating whalebone, but also for horn and tortoise-shell, where, owiug to the heat generated by the friction, the particles of those matters abraded by the drill, are agglutinated or partially fused together; and he had himself great difficulty to get out a drill which he had employed in making a hole in a tortoise-shell box for a friend of his, and which had so fixed itself.

Our readers will find the description of a drill, used by cutlers in perforating horn, tortoise-shell, or other similar matters, in our second volume, page 145. This drill is *semi-cylindrical,* with a rounded point, and constantly drives out the borings. The above umbrella drill was made exactly according to our description of the drills for brass, but with the addition of cutting sides to it.

In fact, the improved drill bears a very great similitude to the *hand*-drill for perforating hard wood in the lathe, described in page 58, excepting in the form of its point, which is much more acute than the present one.

XIII.—*On a pretended Perpetual Motion. By a* CORRESPONDENT. *With Observations by the* EDITOR.

SIR, *Bury St. Edmunds, Suffolk, Dec.* 10, 1825.

SOME few years since, a person exhibited in Bury, a perpetual; or pretended *perpetual motion,* of which the maintaining power was *magnetism.* The invention consisted of two horse-shoe magnets, fixed in an horizontal plane, with their poles opposite to each other, and a few inches apart; between them was placed a small needle, similar to that of a compass; but, instead of the cap and point suspension, it was fixed at right angles to a light perpendicular axis, and it was pretended that the powers of attraction and repulsion of the two magnets kept the needle in a perpetual and very rapid rotatory motion. Between the two poles of each magnet was fixed a small block of a black substance, which, the exhibitor asserted, was a mixture of metals, possessing the power of intercepting the magnetic influence; but beyond this, he was, or pretended to be, entirely ignorant of the principle of the invention; which he stated was not the fruit of his own ingenuity, but of some person whose name I forget, and who bequeated it to him on his death-bed. Accidentally meeting with some numbers of the *Mechanics Magazine,* a few days since, I found a description of a perpetual motion, which, I have no doubt, is the very same, but there is no attempt at explaining the principle upon which it is constructed. As you have already, in your valuable *Technical Repository*, exposed one or two impositions of this kind, perhaps you will not deem the one I have attempted to describe below your notice; if it were a perpetual motion, as many imagine, it seems deserving of consideration for its great ingenuity; and if not, a detection of the fraud may serve, in some measure, to prevent similar impositions.

Allow me to observe, that a description of the mode of forming the steel cutters, mentioned in your last volume, page 303, would be particularly acceptable to many country workmen, as well as to myself,

who am, sir, your obedient servant,

To T. Gill, *Esq.* A. E.

Observations by the Editor.

We must own that we cannot possibly conceive what benefit can be derived from the continual publication of pretended *perpetual motions!* They merely serve to gratify that perverted appetite for the marvellous, which, unfortunately for true science, is always too much prevalent.

We have no doubt that, had we seen this imposture, we should very soon have detected it; and indeed, believe that the rapid revolutions of the needle were caused by some connection of it with a moving power, conveyed through the perpendicular axis. Unfortunately, those persons who visit these exhibitions, are but too much delighted with the surprise excited thereby: and, therefore, instead of calmly setting about the detection of the trickery, and we may say *knavery*, practised upon them, they lend themselves to the delusion, and go about seeking for others to be deluded also.

We now know, indeed, that *electro-magnetism*, or the united powers of magnetism and galvanism (or the voltaic pile), are fully equal to produce a rapid rotatory movement; but our correspondent makes no mention of the latter power being employed in this case, nor is it probable that it could have been a few years since.

We shall not fail to comply with his wish, in describing the formation of the steel cutters, for the butts of wheels, pinions, racks, &c., in the progress of our work.

XIV.—*On the advantages of Burnishing the Edges of the Mathematical and Philosophical Instrument makers' turning tools for Brass; and on Varnishing their Brass-work. By the* EDITOR.

SINCE the publication of our remarks on the mathematical and philosophical instrument makers' practice of *burnishing* the edges of their turning tools, for brass; we have been favoured by a friend with some particulars of the advantages they derive from this improvement. He stated, that, were they to employ pieces of pumice-stone, or the water of Ayr-stone with water, to remove from their turned brass-work the marks left by the turning tools, as is usually done by workmen in general, their work would lose that *beautiful accuracy of finish, and sharpness of detail* for which it is so deservedly esteemed; and which are entirely owing to its being finished by the burnished edges of their turning tools. And, indeed, nothing more is required afterwards than the mere application, first of a little finely powdered pumice-stone, and then rotten-stone mixed with oil, upon leather, to give their work that high polish which fits it to be lacquered, and thus to preserve that polish for a great length of time.

We have seen the brass-work after the polish was given to it, by the rotten-stone and oil, and whilst still covered with the oil, coated with fine whitening, and which served still more to heighten that polish, when, with the help of more whitening, it was cleared off the work by rubbing it with the fingers; and lastly, after wiping it clean from the whitening, the work was immediately secured from tarnishing, by being put on an iron plate, heated over a gentle charcoal fire, and the spirit varnish being brushed over it whilst it was hot, dried instantly.

We are acquainted with an excellent workman in this line, and who also prepares *pure potash*, by the aid of alcohol; and which alcohol, after distilling it from the potash in a silver alembic, he employs in dissolving *the lightest coloured seed-lac* to form his *securing varnish;* and he thus obtains a better, and a more durable varnish than he could ever procure in any other way.

XV.—*On the employment of the Anthracite, or Stone Coal, as Fuel, in the United States; with Suggestions for its use here also, as well as Gas-coke.*

SINCE the appearance of the article on this subject, in our last volume, page 366, we have been favoured with the following information thereon, from an American gentleman.

He states that the anthracite is burned in narrow upright grates, made on purpose, with bars in front and behind also; and that the fire is not of any great bulk, but is, perhaps, only about six inches in thickness.

It appears, from this description, that all that is necessary is *to afford a plentiful supply of air to this fuel*, more than is commonly done in the consumption of the ordinary or *bituminous coal;* and also to avoid its contact with broad plates of cast-iron, such as are usually employed in the construction of our common grates. And we may add, that the same reasoning equally applies to the consumption of *gas-coke*, which ought likewise to be burnt in grates, having provision made in them to allow of the perfect access of air to support the combustion of the coke. And we should thus be furnished with a cleanly, steady, and exceedingly durable fire, free from the annoyance of smoke, common to all fires made with the ordinary coals.

XVI.—*Remarks on the Cutting of Steel by Soft Iron. By Mr.* THOMAS KENDALL, *Junior* *.

New Lebanon, Aug. 8, 1825.

MM. Darier and Colladon's statement, in a memoir published by them, that a copper wheel exercised no action upon steel, goes far to prove that the effect depends at least as much on *heat softening the steel,* to a certain degree, as on *percussion,* copper having but little disposition to generate heat under any circumstances, a fact duly appreciated by the manufacturers of gunpowder.

The reason why "the heat should be nearly all concentrated in the steel, and scarcely perceptible in the iron," I think to be this: the percussion against the steel is *continual,* but against any one part of the iron cutter perhaps not more than from 1-200th to 1-600th part of the time; consequently the heat received by each would be in an inverse proportion of the *thickness* of the steel to the *circumference* of the iron, after making the proper allowance for what may be thrown off from the circular cutting iron in its passage through the air, which must be considerable.

P.S. As evidence of the absence of heat, it is stated in the memoir of MM. Darier and Colladon, that the small particles of steel adhering to the edge of the cutter, "seen through a lens, did not appear as if untempered, and when tried with a file were found as hard as the best tempered steel."

I have never observed the appearance of the particles, or examined their temper, but have examined the burr raised in cutting a plate of steel, which before the operation was sufficiently soft to file with ease, but in the operation became hardened on the outer edge much harder than before, which was evidently caused by the great heat, and by being suddenly cooled by the current of air caused by the motion of the cutter; the same would be the case with

* From the American Journal of Science and Arts, vol. x.

particles disengaged by heat, or when hot, and adhering to the edge of the cutter; the process of hardening in air is applied by artists to the hardening of very small drills.

XVII.—*On an American Wool-spinning Frame, invented by Mr.* Gilbert Brewster*.

The Brewster frame is so constructed that, by the continued rotatory motion of the main shaft, to which the moving power is applied, all the operations that are performed by the hand on the single domestic wheel, of drawing out, twisting, and winding up the yarn, to form the cap are perfected, leaving to the attendant no other labour than that of joining the threads as they may occasionally break. The direction of the draft being vertical, the frame occupies not more than one-sixth of the space required for jennies doing the same amount of work, and enables the attendant to mend the threads with much greater convenience. The length of the draft, or quantity of slubing to be drawn out, and the time of throwing in and continuing the twist being comprehended within the principle of the frame, they may be varied at pleasure. It is only necessary for the person in attendance, after ascertaining the description of yarn she is wished to spin, whether fine or coarse, hard or slack twisted, to adjust the frame with a wrench to the quality, shortening or protracting the period of the closing of the jaws on the slubing, as she may wish it finer or coarser, and varying the time of carrying on and off the belt from the twisting cylinder, according as she may desire her yarn hard or slack twisted. When once adjusted, the frame continues in the same state, producing a uniform thread, and possesses the additional advantage from its mechanical construction, and the uniform regularity of its movements, of furnishing, if required, a thread slacker twisted for

* From the American Journal of Science and Arts, vol. x.

filling; and for warp, one harder twisted than can be spun on a jenny. The expense of keeping a frame in repair, and the power necessary for its successful operation, are not greater than is required by power jennies doing the same work. A frame of 300 spindles will spin 300 runs, 1600 yards to the run, per day, and will with ease turn off 100 lbs. of four run yarn in twelve hours. Two girls of sixteen years of age will attend a three hundred spindle frame, one on each side.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since Nov. 24, 1825.

To Augustus Count de la Garde, of St. James's-square, Pall-mall, in the county of Middlesex; who, in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of certain improved Machinery for breaking or preparing Hemp, Flax, and other Fibrous Materials. Dated Nov. 24, 1825.—To be specified in six months.

To Joseph Eve, of Augusta, Georgia, in the United States of America, but now residing at Liverpool, in the county of Lancaster, engineer; for an improved Steam Engine. Dated Nov. 24, 1825.—In six months.

To Henry King, of Norfolk-street, Commercial-road, in the county of Middlesex, master-mariner; and William Kingston, of our Dock-yard, Portsmouth, master-millwright; for certain improved Fids for Topmasts, Gallant-masts, Bowsprits, and all other Masts and Spars, to which the use of the Fid is applied. Dated Nov. 26, 1825.—In six months.

To Richard Jones Tomlinson, of the city of Bristol, gentleman; for an improved Frame-work for Bedsteads and other purposes. Dated Nov. 26, 1825.—In six months.

To Marc Lariviere, of Prince's-square, Kennington, in the county of Surrey, mechanist; for certain Apparatus or Machinery, to be applied to the well-known Stamps, Fly Presses, or other Presses, for the purposes of perforating Metal Plates, and for the application of such perforated Metal Plates to various useful purposes. Dated November 28, 1825.—In six months.

To William Pope, of Ball-alley, Lombard-street, in the city of London, mathematician; for certain improvements on Wheeled Carriages. Dated Dec. 3, 1825.—In six months.

To William Pope, of Ball-alley, Lombard-street, in the city of London, mathematician; for certain improvements in making, mixing, compounding, improving, or altering the article of Soap. Dated Dec. 3, 1825.—In six months.

To Henry Berry, of Abchurch-lane, in the city of London, merchant; for an improved method, in different shapes or forms, of securing Volatile and other Fluids, and Concrete or other Substances, in various descriptions of Bottles and Vessels. Dated Dec. 3, 1825.—In six months.

To Ezekiel Edmonds, of Bradford, in the county of Wilts, clothier; for certain improvements on Machines, for scribbling and carding Sheeps' Wool, Cotton, or any fibrous Articles requiring such process. Dated Dec. 3, 1825.—In six months.

To John Beever, of Manchester, in the county of Lancaster, gentleman; for an improved Gun-barrel. Dated Dec. 3, 1825.—In six months.

To Edmund Luscombe, of East Stonehouse, in the county of Devon, merchant; who, in consequence of communications made to him by a certain foreigner residing abroad, and discoveries made by himself, is in possession of a method of manufacturing or preparing an Oil or Oils, extracted from certain vegetable substances, and of the application thereof to gas-light and other purposes. Dated Dec. 6, 1825.—In six months.

To John Phillips Beavan, of Clifford-street, in the county of Middlesex, gentleman; who, in consequence of communications made to him by a certain foreigner resident abroad, is in possession of an invention of a Cement for building and other purposes. Dated Dec. 7, 1825.—In six months.

To Francis Halliday, of Ham, in the county of Surrey. esquire; for certain improvements in Machinery, to be operated upon by Steam. Dated Dec. 9, 1825.—In six months.

To Joseph Chesseborough Dyer, of Manchester, in the county of Lancaster, patent card manufacturer; for certain improvements in Machinery for making Wire Cards for carding Wool, Cotton, Tow, and other Fibrous Substances of the like nature; and also certain improvements on a Machine for shaving and preparing Leather used in making such Cards. Dated Dec. 9, 1825.—In six months.

To Robert Addams, of Theresa-terrace, Hammersmith, in the county of Middlesex, gentleman; for a method of propelling or moving Carriages of various sizes on Turnpike, Rail, or other Roads. Dated Dec. 14, 1825.—In six months.

To Matthew Ferris, of Longford, in the county of Middlesex, calico-printer; for improvements on Presses, or Machinery, for printing Cotton and other Fabrics. Dated Dec. 14, 1825.—In six months.

To James Ashwell Tabor, of Jewin-street, Cripplegate, in the city of London, gentleman; for means for indicating the depth of Water in Ships and Vessels. Dated Dec. 14, 1825.—In two months.

THE

TECHNICAL REPOSITORY.

XVIII.—*On an improved Mode of Working the Injecting Pumps of* BRAMAH'S *Hydro-Mechanical Press, and other Pumps. Invented by Mr.* JOHN SPILLER, *Engineer, Chelsea**.

WITH A PLATE.

THE powerful instrument called Bramah's Press is so well known, that we need not enter into a particular description of its construction. Next to the steam-engine, it has proved the most generally useful mechanical invention of modern times. It is applied, and is applicable, in all cases where intense pressure or great power is required. In our manufactories it is used for discharging colours, for pressing paper, gunpowder, &c., for packing cotton and other light goods, for expressing oils; and in bleaching, for expressing water instead of wringing. The press is also used for drawing up piles, for rooting up trees, and for cranes for loading and unloading goods.

But, valuable as this instrument is, it has an imperfection when applied in the ordinary manner to certain purposes, such, for example, as packing cotton, discharging dyes, and expressing oils. The imperfection consists in the great variation in the power necessary to work the press at different periods of the operation, in consequence of the variable resistance of the materials under pressure at the different states of compression, which not only

* From an account furnished by Mr. Tredgold, Civil Engineer, to the Editors of the Edinburgh Quarterly Philosophical Journal, Jan. 1826.

causes loss of time, but also, when the pumps are worked by an invariable power (as they must be when driven by inanimate power) it renders the stress on the first mover irregular.

Several methods had been tried to remedy this inconvenience, but none of them succeeded in doing more than diminishing the variations in a small degree; but the invention we are now about to describe effects the purpose, and by a contrivance so simple, ingenious, and beautiful, that we are assured our mechanical readers will be interested by its description.

The effect in Bramah's press is produced by pumping a certain quantity of water into the press cylinder at each stroke of the pump; and if, with an invariable power, only one pump be employed, the quantity injected at one stroke must not be greater than can be forced in when the press is exerting its greatest pressure. Hence, in such a case as expressing oil from seeds, where the resistance in the first part of the operation is small, and increases till the compression is considered to be sufficient, the machinery must be adapted for working the pumps when at the maximum pressure, and consequently there must be a great excess of power in every other part of the operation.

In any hydro-mechanical press the power is proportional to the quantity of water injected, at a stroke of the pump, multiplied into the resistance; therefore, when the resistance is small, the quantity of water injected at a stroke should be increased, in order that the power necessary to work the press may be as uniform as possible, and this is the object of the patent we are about to describe *.

The machinery is applied to an oil-press (see Plate III. fig. 1), of which M is the press-cylinder, and N N′ the bags containing the seeds; one part of the drawing show-

* The discovery of this improved method of working the press was made by Mr. Spiller, and for which a patent was lately obtained by him in conjunction with Messrs. Bramah.

ing the exterior, and the other a section of the press-boxes which contain the seed bags. L L′ are the tubes which convey the water injected by the pumps to the press-cylinder M.

I is the cistern for supplying the pumps with water, and it supports the pumps and the machinery for working them by means of the pillars H H′.

The power which works the pumps is applied to the shaft E′, and is regulated by a fly-wheel; and the motion is communicated to the other shaft E by the toothed wheels F′ F. The two pump-pistons C C′ are worked by the cranks D D′, on the ends of the shafts E E′; and the cranks are made to adjust by set-screws, so as to limit the length of the stroke to any required quantity within the limits of their action. The cranks act on the pump-pistons by connecting rods and slings in the usual manner.

The pump-cylinders A A′ are connected by the copper tube B B′, which is again connected to the junction-piece K by a single tube. The junction-piece K contains the stop, forcing, and discharge valves, and is connected to the tubes L L′, which convey the water injected by the pumps to the press-cylinder.

This is the arrangement of the parts; and, in the next place, we have to explain the principle and manner of producing any assigned variation in the quantity of water to be injected at one stroke.

In the machine we are describing, this is effected by making the two pumps of equal diameter, and equal length of stroke, and the wheels F F′ of unequal diameters, the larger wheel F′ having one tooth more than the smaller one F; consequently, the wheel F, which has eighty teeth, will make one revolution and one-eightieth part, while the wheel F′ makes only one revolution, and the increase of one-eightieth of a revolution at each stroke by the wheel F will, at the end of twenty strokes, cause the cranks to be at right angles to one another, supposing them to have been parallel at the commencement;

and, at the end of forty strokes, the one crank will be commencing its up stroke when the other is commencing its down stroke, and as then their motions are in opposite directions, the one will counteract the effect of the other, excepting that small portion of effect which is due to the difference of their velocities. Therefore, if the difference of their velocities be made small enough, a given power may be made capable of producing any assignable degree of pressure at the completion of the time when the smaller wheel has gained half a revolution on the larger wheel. It is obvious, that the number of revolutions to produce this effect must be greater the smaller we make the difference between the velocities of the wheels.

Let a denote that arc of a circle which the one wheel gains on the other at each revolution, or stroke of the pump; then, if we make the machine commence when both the pistons are at the bottom, the water injected at any number n of revolutions of the large wheel will be proportional to $2 + \cos n\,a + \cos \overline{n - \frac{1}{2}}\,a$.

For the pump acts effectively only during the time both pistons are descending. Therefore, if the machine begin with both its pistons at the lowest point, and the motion be continued till both begin to descend, it will be found that the crank of the small wheel has advanced half the arc a beyond the upper point, and consequently must begin its stroke from thence, while the crank of the larger wheel begins at the top. Also, when the crank of the large wheel has arrived at the distance a from the lowest point, the crank of the small wheel will begin to ascend; and the radius of the cranks being unity, the effective length of the stroke of the one pump will be $1 + \cos \frac{1}{2}\,a$, and the other $1 + \cos a$; consequently, the sum of the strokes is $2 + \cos a + \cos \frac{1}{2}\,a$. In the second revolution the effect in length of stroke of both pumps is $2 + \cos 2\,a + \cos (1 + \frac{1}{2})\,a$; in the third we have $2 + \cos 3\,a + \cos (2 + \frac{1}{2})$; and in the ninth stroke it is $2 + \cos n\,a + \cos (n - \frac{1}{2})\,a$.

When $n\,a = 180°$ its cosine is -1, and the effect is $1 + \cos \overline{180 - \frac{1}{2}\, a}$.

The total quantity of water injected during n strokes will be as $2n +$ sum of the $\cos n\,a +$ sum of $\cos \overline{n - \frac{1}{2}}\, a$; and by Gregory's Trigonometry, art. 21, note,

$$2n + \frac{\sin \frac{n}{2} a . \cos \frac{n+1}{2} a + \sin \frac{n - \frac{1}{2}}{2} a . \cos \frac{n + \frac{1}{2}}{2} a}{\sin \frac{1}{2} a.}$$

If we neglect the difference between $\cos n\,a$ and $\cos \overline{n - \frac{1}{2}}\, a$, the area representing the total effect of the two pumps will be a rectangle, of which the one side is equal to the diameter of the circle described by the cranks; and the other the sum of the areas of the pumps, multiplied by the number of strokes necessary to cause the small wheel to gain half its circumference on the other.

The quantity of water injected at any number n of strokes will be very nearly

$$2\,n\,A\,r \left(n + \frac{\sin \frac{n}{2} a . \cos \frac{n+1}{2} a}{\sin \frac{1}{2} a.} \right).$$

In this formula A is the sum of the areas of the pumps, $r =$ the radius of the cranks, n the number of strokes, and a the arc the small wheel gains in one revolution of the larger one.

To illustrate this subject more clearly, we have annexed the diagram, fig. 2, where D′ is the crank of the larger, and D that of the small wheel; and we suppose the crank D, in this case, to gain half a revolution at the end of 12 strokes. The crank D will begin its effective stroke successively at the points 1, 2, 3, &c., and always terminate its stroke at b. The crank D′ will, on the contrary, always begin its effective stroke at a, and terminate it successively at 1, 2, 3, &c. The shaded space A B D will be proportional to the effect of the pump worked by the crank D′, and the parallelograms 1, 2, 3, &c., show the effect at the first, second, &c. strokes. The shaded space A C D is proportional to the effect of the pump worked by the crank D; and the effect of the first, second, &c. strokes are shown by the parallelograms 1, 2, 3, &c.

The mode of describing the figure is obvious, as the length of each stroke is equal to the vertical distance between its commencement and termination. The sum of the figures representing water injected by each pump is very nearly equal to the parallelogram A B C D; the small spaces which are not shaded show the parts wanting.

If the shaded space A B D were turned, so that the point B coincided with the point C, and the line A B with the line D C, the figure would then show the decrease of the quantity of water injected at each revolution; or, in other words, the variation produced in the power of the press by the use of the principle described in the patent.

The case to which this improvement is at present applied, is one in which the advantages of the hydro-mechanical press are very considerable. It enables those who use it to conduct the same quantity of business with a less number of workmen; there is less wear and tear of bags and wrappers; the machinery occupies less space; and the destructive effect of the concussions of heavy stampers on buildings and machinery is avoided entirely; indeed, so smooth and noiseless is the operation of one of these presses, that the business of expressing oil may be conducted any where, without disturbance to the neighbourhood.

The application of the principle of the patent is not, however, confined to presses, for the effect of any power which has periodical variations of intensity may be made to produce a continuous effect, proportional to the power by the application of this principle. One of the most obvious cases is that of tide-pumps; and, if we recollect right, a considerable premium was offered for such a mode of working tide-pumps, by some of the societies for encouraging the arts, in the Low Countries.

XIX.—*Experiments on the action of Water upon Glass, with some observations on its slow decomposition. By Mr.* T. Griffiths, *Chemical Assistant in the Laboratory of the Royal Institution.**

It is a commonly received notion that glass is capable of resisting, to a very great extent, the attacks of active chemical solvents, and that its alkali can neither be readily separated nor exhibited in an insulated form without regularly submitting it to powerful decomposing agents.—Speaking of glass, in common language, without any reference to the many soluble compounds so designated, it may be a new fact in chemistry to prove that this singular substance possesses highly alkaline properties, which may easily be shown by the usual tests.

Upon reducing some thick flint glass to a moderately fine powder in an earthenware mortar, for the purpose of analysis, a portion of it was placed on turmeric paper, with the view of determining if it possessed any sensible alkaline property; and, upon being moistened with water, the yellow colour of the test-paper was instantly reddened nearly as powerfully as if lime had been employed.

This effect was considered as accidental, and as probably arising from some adventitious alkaline matter, or soap, adhering to the vessels employed. Another experiment was made, with greater care, in an agate mortar, but with the same, or even a more decided result, in consequence of the more minute division of the material. When pulverized on perfectly clean and polished surfaces of iron, steel, zinc, copper, silver, and platinum, the effect took place, and apparently with equal facility: but it was found that the presence of small quantities of oxide of iron greatly diminished it, in consequence, as was afterwards proved, of the particles of glass being by them defended from the contact of water.

* From the Quarterly Journal of Science, Literature, and the Arts. No. XL., 1826.

Since there are some saline bodies and metallic combinations which give indications of alkali to turmeric-paper, although perfectly neutral compounds, and as pure magnesia reddens this paper when moistened with water, although no solution can be shown to take place, possibly this might be an effect of the kind, it scarcely appearing probable that any soluble matter should be abstracted from the powdered glass by the mere affusion of pure water. Litmus-paper, therefore, reddened by an acid, and paper stained with the blue infusion of cabbage, were also employed as tests; the former had its blue colour restored, and the latter was rendered green.

A portion of flint-glass in fine powder was boiled in water for some hours; upon being allowed to cool, and subside, the clear portion was decanted and evaporated, and became strongly alkaline to the taste, and to other usual tests; a drop of its concentrated solution, gradually evaporated on a glass plate, on exposure to the atmosphere, in a short time became deliquescent. Tartaric acid produced an effervescence, and afterwards a precipitate in this solution; as likewise did muriate of platinum. From these experiments, therefore, it may be fairly inferred that the alkali removed from the glass was potash in an uncombined state, and that the alkaline effect observed in the first instance did not depend upon the presence of any alkaline salts, or combination, adhering to or diffused throughout the glass.

The remaining sediment from the above solution, after having been repeatedly washed in successive portions of water, became inert as to its action on test-papers, not affecting their colours in the slightest degree; but, upon *trituration*, its alkaline power was again developed; this property being evidently dependent upon the exposure of a new or undecomposed surface. A slight application of heat to the water, was found greatly to facilitate this evolution of alkali.

In order to determine the quantity of alkaline matter abstracted from a given weight of glass, by long and continued boiling. 100 grains, of flint-glass, in fine powder, were boiled nearly every day for some weeks, in two or three successive portions of water; after this process, the insoluble residue was found deficient in weight by nearly seven grains. This result, however, must not be considered as accurate, but as a mere approximation: for, on the one hand, small portions of glass might have been carried away in the supernatant liquor; and, on the other, more alkali might have been abstracted by repeatedly triturating during the process, which, under these circumstances, would be almost unlimited.

To some pure dilute muriatic acid was added very fine flint-glass, in powder, till it was completely neutralized by its alkaline effect. Upon being allowed to subside, (which, however, was not very readily effected, minute particles remaining suspended for weeks together,) the clear portion afforded a crystalline salt on evaporation, having the characters of muriate of potash.

It may be remarked that this solution, *when perfectly clear*, contained no lead, on testing for it by sulphurretted hydrogen; but upon agitating or diffusing the fine powder of glass through water, holding the gas in solution, it was immediately discoloured, or blackened.

Flint-glass, although chosen for the above experiments, is not the only variety possessing this remarkable property, crown and plate-glass, white enamel, and what is more remarkable, Newcastle green-bottle glass, and tube of the same material, (in the composition of which there is, comparatively, little alkali,) also Reaumur's porcelain, made from the green bottle glass, possess the power of acting upon vegetable colours as alkalies.

These experiments, tending to prove that glass is a body of irregular composition, parting readily with its alkali by the action of water, it became a matter of some interest to determine how far certain natural combinations of potash with siliceous matter were equally active to the same tests, especially as in green-bottle glass, which contains little alkali, it is thus rendered evident. No analogous effect could, however, be produced by powders of felspar, basalt, green-stone, granite, obsidian, pumice, and some others, even when boiled with water, a method which never failed to produce it rapidly with glass, although cold water is perfectly sufficient.

Some interesting conclusions may be drawn from the above experiments, which may tend to explain several well-known phenomena.

In the first place, with regard to the glasses employed in the laboratory, or for domestic uses, it must be evident that water has the power of acting upon and dissolving the alkali at the surface, and leaving an insoluble portion spread as a coating over the interior of the vessel, defending it from further immediate action.

Where, however, time can be allowed, the effect does not appear to be confined to mere surface. In collections of ancient glass, specimens may be selected, exhibiting how extensively an analogous action has been going on during the period they have remained buried in the earth. These vitreous relics of antiquity are often covered, to a considerable thickness, with opal pearly scales of beautiful appearance, consisting almost wholly of silica, whose alkali had been removed probably by the action of the water.*

A fragment of transparent ancient glass was examined with regard to its alkaline property, which it was found to enjoy in a high degree, being sensibly alkaline (when in powder) to the tongue, and its hot solution acting upon the cuticle. It appeared to consist almost entirely of potash and silica; not the smallest trace of lead being discoverable in it; several other coloured specimens of ancient glass,

* The opal is an hydrate of silica: may not its formation have taken place by a similar agency acting upon natural combinations? The removal of alkali from siliceous compounds may have left opal thus constituted.

upon examination, were, in every case, more highly alkaline than any modern glass containing lead, that has hitherto been examined.

The specific gravity of common flint-glass was taken by way of comparison with the ancient fragments above mentioned, the result of which is here given. Flint-glass, S.G., 3.208. Ancient glass, 2.375. It may here be remarked, that the latter acted powerfully upon the test-paper, by merely moistening it, without reduction to powder. It cannot be surprising, therefore, that ancient glass, which may almost be called pure silicate of potash, should be occasionally found in states of such rapid decay, as the specimens in collections often exhibit.

Another proof of the action of water, aided by other concomitant circumstances, in producing decomposition upon glass, is an account given in vol. I. p. 135 of this Journal, of some bottles of wine found in a quantity of black mud at the bottom of an old well, full of burned wood, supposed, upon good authority, to be of anterior date to the fire of London. The siliceous earth, in this instance, separated in films on the surface of the bottle, in consequence of the abstraction of alkaline matter, probably by the action of water, aided perhaps originally by a certain degree of heat, and afterwards by the long period of their continuance in a situation favourable to the decomposing agency.

In contact with ammoniacal, or decomposing animal matter, the disintegration of glass takes place more rapidly. Stable-windows, and bottles kept in such situations, often present a very beautiful iridescent appearance, in consequence of the siliceous matter being developed in thin plates on its surface, often amounting to a pearly, and sometimes almost metallic appearance; an effect which, it is believed, has not been hitherto investigated.

Solution of potash acts very rapidly upon glass, as the chemist often inconveniently learns by the effect produced upon the bulb of a thermometer, employed to determine its boiling point, and which is always found corroded to a considerable extent after the experiment.

It may also here be remarked (although not perhaps immediately connected with the subject), that from frequent observations by a person in the habit of using solid carbonate of ammonia, that the flint-glass bottles in which it has been for some time kept are invariably rendered much more brittle, and pieces of glass fall out upon very slight motion of its contents. This fact is merely mentioned as curious, and may probably be hereafter more fully examined.

Observations by the Editor of the Technical Repository.

We are glad to find Mr. Griffiths's attention directed to this interesting subject, and would recommend to him to call in the aid of the microscope in his farther investigation of it. We have long had both opaque and transparent objects prepared for examination, by merely scraping off a few scales of the decomposed surface of green or black bottle glass: as a transparent object in particular, they present a very curious appearance, their surfaces being generally covered with minute spots, in some places larger and of a round or irregular elliptical shape. Not only have they the appearance of pearl, but they are also coloured in reality throughout their whole substance, and present a pleasing variety of yellow, orange, red, green, and other colours; and, which is more curious, in some parts they are covered with *regular crystals of salts, arranged in bundles or groups, and crossing each other.*

XX.—*On the Blowing of Air into Furnaces, by a Fall of Water.* By the late celebrated WILLIAM LEWIS, M.D.

(Concluded from page 16.)

WITH A PLATE.

I HAVE received an account from a worthy correspondent in Switzerland, of a machine which he has constructed for a smelting furnace according to the foregoing directions: he says, it has so much the advantage of all other kinds of bellows, that it deserves to be introduced universally wherever the situation of the place will permit. The only inconvenience he finds in it is, that the cullender and gratings are liable to be stopped up with leaves, &c. With regard to the cullender, the obstruction may be obviated by enlarging the holes. The gratings ought to be of a large surface: the wire grating in the cistern on the top may be a cylinder, nearly as large as the cistern will receive, for if it is no more than sufficient to cover the mouth of the pipe, it will doubtless be found choaked up. When so much of the cylinder becomes stopped, that the water has no longer a free passage through, it may be lifted up and cleaned, another being placed in the room of it, without the trouble of turning off the water, or interrupting the going of the machine. The gratings here can be liable to no other inconveniences than those which are common in other water-machines, mills, aqueducts, &c.

Some further improvements have occurred in the construction of these machines, by which they may be made effectual in cases, when the quantity of fall of water would otherwise be insufficient.

Of constructing Blowing-Machines, with Falls of Water of great height.

WHERE the height of the fall is great, the quantity of water is usually small; and in all the ways of application that have hitherto been contrived, the height will by no means make amends for the deficiency in quantity.

In the common construction of these machines, where the upper pipe, or funnel, is no more than three, four, or five feet high; though the fall should be such as to admit of the lower pipe being thirty or forty feet or more, it does not appear that any material advantages could result from such a height. For, as the air is admitted into the water only at the top of this long pipe, it cannot, I think, be supposed that the quantity admitted will be the greater for the length of the passage under the place of its admission. Water indeed has been found by Marriotte to run faster through an upright long pipe than through a short one: a quantity of water which was forty-five seconds in running through a pipe three feet long, was discharged in thirty-seven seconds, or near a sixth part less time, through a pipe of the same bore, and a double length; so that, as more water passes successively through the long pipe than through a short one, in equal times, more air also must be carried down by it. But in the case which we are here considering, no benefit can be expected on this principle; for as the supply of water is supposed to be limited, the bore of the pipe must necessarily be made less, in proportion to the increase which its length may produce in the velocity. If the lower pipe is of such a height that the watery column it contains may sufficiently resist the force of the air in the air-vessel, it should seem that any further addition to its height could be of no manner of use.

We have seen, in the foregoing part of this essay, that it would be more advisable in such cases to shorten the lower pipe, and to lengthen the upper one: by this means the water, acquiring greater velocity at the place of its discharge from the upper pipe into the lower, is enabled to divide or spread more, and thus to receive more air into its interstices. The advantage thus obtained does not, however, increase in so great a proportion as the height does.

From an experiment above related, it appears, that by increasing the height four-fold, the effect was not increased three-fold; and this even in small heights, where the effect is much more influenced by a variation in height than in great ones.

The observations already mentioned, point out the means of availing ourselves more advantageously of high falls, so as to produce always with certainty, from a fall of a double or treble height, a double or treble effect, if the quantity of water be the same, or an equal effect, with one half or one third the quantity of water.

Experiments have convinced me that a fall of fourteen feet is more than sufficient for compressing the air to such a degree as to be able to sustain the gauge to the height of four feet; or to raise, on an opening of a square inch, a weight of about a pound and three-quarters avoirdupois, or above two pounds troy; a compressure which is apprehended to be as great as there will in general be occasion for. Where we have plenty of water with such a fall, we can drive in air, with this force, in any quantity: for if one machine, with a certain portion of the stream, produces a continued blast of this strength, through a pipe of a certain bore, as an inch, or three-quarters of an inch; it is evident that the quantity of air may be doubled, trebled, &c. at pleasure, without diminishing the compressure or force of the blast, by adding another and another machine, till all the stream is employed. It is plain, in like manner, that the same advantage may be received from high falls, by placing one machine over another; that after the water has performed its office in falling through one machine, it is still capable of exerting the same action in another and another machine, so long as equal spaces remain for it to fall through; so that the total effect must be the same as if a quantity of water, sufficient for working all the machines, came at first in one stream.

A fall thus divided, is represented in plate IV. fig. 1. In the lower machine, whose air-vessel is sunk to a considerable depth in a pit made in the ground, the water is forced up in the pit, on the outside of the vessel, four feet higher than the surface of the water within the vessel, or of the stone on which the water dashes, called by the workmen the dash-board. The air-vessel of the upper machine having an additional part at one side, which performs the same office as the pit, the water is in like manner forced up to the same height in this outer part; which outer part serving as a reservoir for the machine under it, the water begins to act in this lower machine four feet higher up than the dash-board of the first. Whatever number of machines the fall will admit of, the case is the same in them all: though in each of them the water falls eighteen feet, yet as it is pressed up again four feet for the succeeding machine, one machine takes up but fourteen of the real fall.

The outer vessel, and its communication with the air-vessel, may be conveniently formed by an upright partition in the air-vessel itself not reaching quite to the bottom. The outer division may be open at top, and need not be so high as the close air-vessel, it is full sufficient if it reaches a little more than four feet above the level of the dash-board, the water which it is designed to receive not rising higher than this. In other respects, the structure of these machines agrees entirely with that of the single ones already described. It must be observed only, that the cullenders of the lower machines should be, as nearly as possible, of the same dimensions with those of the upper ones. For if they are of smallar bores, they will not admit of all the water which passes through the upper ones, so that part of it must run to waste; if they are larger, the water will pass off too fast, without producing its due effect. The regulators before described are here particularly useful, affording ready means of increasing or diminishing the apertures in the cullenders occasionally, while the machines are at work.

Of Blowing-Machines with low Falls of Water.

The dimensions hitherto given are such as appear the most advantageous. Much lower falls, however, than these which the foregoing machines are calculated for, as ten, eight, or perhaps seven feet, may be made to afford a strong blast. To produce such a compressure of the air in the air-vessel, as to raise the gauge four feet, a fall of about six feet is necessary for the lower pipe. If the upper pipe is only about a foot and a half or two feet, the water, when divided by means of the cullender, will carry down a certain quantity of air; and though the quantity, from an equal stream of water, will not be so great as when the fall is higher; yet, as there are in many parts of the kingdom large bodies of water running with such a descent, the deficiency may be compensated, as already noticed, by enlarging or multiplying the machines.

For many purposes, still less falls will suffice. The smith's bellows, as we have formerly seen, raises the gauge only about fourteen inches; and such a compressure, it is presumed, may be gained from a fall of five feet or less. Small falls may be applied also to another purpose, of no little importance, *the ventilation of mines and coal-pits*, or the driving in of fresh air, in the room of that which the mineral vapours have rendered unwholesome or pernicious.

In all these machines, it must be observed, that the height of the column of water falling through the pipe, determines not the actual force of the blast, but the greatest force which can be given it in that machine: that the height of the gauge is always the measure of the actual force; that this force depends on the width of the pipe through which the air is discharged from the air-vessel, and may be diminished or increased in any degree up to the greatest that the column of water can resist, by widening or narrowing the aperture of the pipe; that different machines will give blasts of equal force through pipes of greater or less width, according to the greater or lesser quantities of air which the water carries down with it; and that, therefore, the size of the blast-pipe must be adjusted by trial, for each particular machine.

The distance of the dash-board under the pipe may likewise admit of some variation, and require to be regulated according to the size of the pipe. In some of the common machines this distance is three or four feet, or more; but so large a space is apparently a disadvantage, for so much of it as is more than sufficient for the free passing off of the water is entirely useless, being, in effect, so much taken off from the height of the fall. The distance of six inches, laid down in the foregoing machines, is designed for a circular pipe of twelve inches diameter; in which case the area, by which the water is discharged all round, is just double to the area of the pipe, and consequently more than large enough for letting the water off without impediment.

Explanation of the Plate.

In plate IV. fig. 1 represents a natural fall of water of twenty-eight feet, formed into two artificial ones of eighteen feet each. This double machine may be presumed to have twice the effect of a single one, in virtue of this division; besides the advantage of the more free admission of air, and the spreading of the stream through a pipe of a much larger bore, by which it is enabled to carry down in its interstices a much greater quantity of air. The dotted lines in the upper reservoir represent a cylindrical grating of iron wire, to keep back weeds, &c. The division of the air-vessel, and the course of the water from the upper machine to the lower, are apparent from the figure.

Fig. 2 is a perspective view of the cullender, screwed to the upper pipe, drawn to a larger scale, to show the disposition of the holes. The holes may be made wider than formerly proposed, as an inch each side, to prevent any danger of their being choaked up.

XXI.—*On the Causes and Cure of the Disease termed the Curl in Potatoes.* By *Mr.* WILLIAM HOLLINS*.

SIR, *Berriew, Montgomeryshire, Oct.* 20, 1789.

HEREWITH I have sent you an account of the disease called curl potatoe, with a certificate which corroborates it, not doubting your Society will judge with liberality; and if the Society shall think it necessary for me to attend, shall be ready to do it.

I am, sir, your obedient servant,

To SAMUEL MORE, *Esq. Sec.* WILLIAM HOLLINS.

The curl in potatoes is a disease which admits of three different stages or degrees.

1st. The half curl.

2d. The curl.

3d. The corrupted.

1st. The *half-curled* plants have leaves somewhat long, and curled only in a moderate degree; they produce a tolerable crop, if the summer be not very dry; but if otherwise, the potatoes will be small and watery.

2d. The *completely-curled* plants are seldom more than six or seven inches high: they soon ripen and die. The potatoes are generally smaller than a nutmeg, of a rusty red colour, and unwholesome as food.

3d. The *corrupted potatoes*, or those in which the vegetative power is nearly destroyed, never appear above ground. The seed may be found, at Michaelmas, as fresh, to appearance, as when it was set, with a few small potatoes close to it.

The first cause of the curl in potatoes must be traced to the manner in which the seed was raised the preceding year.

If the potatoes be set late in the season, that is, from

* From vols. VIII. and IX. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted the sum of twenty guineas to Mr. Hollins for these important communications.

the middle of May to the middle of June, in a rich soil, well manured, having a southern aspect, and if the summer should be hot and dry till (we will suppose) the beginning of August, when the blow of the plants has fallen off, then the seed will be exhausted in feeding the plant only; and very few potatoes will appear. Should the weather now become moist and genial, the plants, especially if they should be earthed, will blow afresh, and a plentiful crop of very large potatoes may yet be produced.

These potatoes are perfectly fit for use as food; but as they were produced from the stalk of the plant, after the seed itself was exhausted, they will be defective in moisture and vegetative power; and the plants which proceed from them the following year will be found to be curled.

Second Cause.

The curl may be produced without manure or earthing, provided the potatoes be sown (at the end of May) thick together, in a rich soil, and covered with green fern, or other litter, before the plants appear. The rain rots the fern or litter, and enables it to penetrate as a manure to the roots; and the plants are forced, as in the preceding experiment, to a second growth, and blow. The seed thus raised produced plants that were curled.

The forcing potatoes by cultivation, as above described, I find to be the cause of the curl, both from my own experiments, repeated for several years successively, and also from the observations I have made upon the practice and ill success of my neighbours.

It is well known that the flowers of many plants, such as the poppy, the rose, and many others, are much altered by cultivation; they become *double*, the stamina are converted into petals, the generic character is lost, they become what botanists call monsters; the parts of generation being changed, no seed is produced. If I may be allowed to consider any part of a plant in which the vegetative power resides as a seed, it will be found that rich cultivation produces, if not absolutely the same, at least a similar imperfection in the potatoe; for the flower and the bulbous root are both enlarged by cultivation. In the flower, little or no seed is produced: in the potatoe, the vegetative power is impaired or destroyed, according to the degree of the disease.

It is observable that, wherever the vegetative power is impaired, there is always a deficiency of moisture; as is proved by the following experiment.

Experiment.

Both healthy and curled plants may be raised from the same potatoe, in the following manner.

Dig up, in the beginning of October, some potatoes raised as is described in the preceding pages. Amongst the largest will be found some that have, in different parts, different degrees of moisture, the least at the butt, and the most at the crown end, the quantity of moisture gradually increasing from the butt to the crown. Take one set from the crown, and another from the butt: the former will produce an healthy, the latter a curled plant. The curl-producing potatoes are also observed to be drier both before and after boiling, and are boiled in a shorter time.

The mode of preventing the Curl in Potatoes.

The following directions for cultivating Potatoes, duly observed, will effectually prevent the curl; as I have found by various and repeated experiments, made with great care and attention, during these last seven years.

The best time of setting, is from the beginning of April to the middle of May. Make ridges a yard asunder: put your manure first into the trench, and with moderation: set the potatoes in a triangular form, five or six inches asunder; cover them with the soil to the thickness of five or six inches. There is but little danger of laying on too much of the soil: the deeper are the sets, the better will they be protected from the scorching heat of the sun, if the season should be dry. This distance of five or six inches is so small as to prevent the plants growing too rank, and yet sufficient for each of them to be exposed to the sun and the air.

2dly. When they have grown to the height of six or seven inches above the ground, you must not earth them, as is the usual practice. You must take away the weeds, and may draw a little mould to them; but you must be careful to do it before the blossom-buds appear, which time is generally about the end of June.

They will now require no farther care excepting that of weeding.

I am of opinion that early setting is advantageous, on account of the greater chance of early rain, which will be very beneficial to the plants if the summer should be dry. By this process the plants will be healthy; the young potatoes will be formed in due season; they will grow gradually; the plant will ripen and die in due time, and will not be forced into a second growth by the rain which may fall in September. The sap being thus left in the potatoe, it becomes a *seed* endued with an unimpaired perfect vegetative power; and the plants which are raised from them will be found to be entirely free from the curl.

N. B. The potatoes may be dug as soon as they can be handled without crushing the peel, that is, about the end of September.

Sound potatoes are procured with the greatest certainty from earth that has been peeled and burnt: the soil thus prepared is well suited to the growth of potatoes. In this they grow gradually, and are not forced beyond their natural size; in doubtful seed, it is safest to plant the smallest potatoes *whole*.

The soil the most likely to produce the curl, is that which is rich in itself, much manured, and has a southern aspect. In other situations, where the soil is not rich, and the garden is cold, either from its being upon the side of a hill, or exposed to the north, the curl has not yet appeared; which is known to be the case in the mountainous parts of Radnorshire and Montgomeryshire. This is perfectly consonant with my theory; for where the soil is poor, and the situation cold, the plants cannot be forced into a second growth by earthing and manure.

I do not mean to dissuade those who are anxious to raise large crops for immediate use, from earthing and manuring to the utmost extent; I only caution them against using potatoes so raised, for seed. By earthing and manuring, you will doubtless raise large crops of large potatoes perfectly good as food, but imperfect as seed; for the vegetative power will be impaired by this forcing cultivation. Hence it will be the interest of every prudent cultivator, to allot a portion of his potatoe-garden to the raising of seed-potatoes. If the directions which I have given be followed, I have not the least doubt of success; at least I am certain that the curl will not make its appearance.

I thought it proper to lay before the honourable Society my first proceedings in the cultivation of potatoes.

I have been a planter of that useful root upwards of twenty years, when the Winter Red was, in general, the kind planted, and before any sign of that disease called the curl appeared. Soon after, the white kind, called here the Golden Dabb, was planted; these were a very palatable kind, but now most subject to curl; which kind I have planted these ten years, and never changed my seed.—A little time after, a new method of planting took place, such as is in use at present, ridging the ground, and manuring well with earthing, which caused this new kind to prove very productive; and producing crops of a much larger kind than those first planted.

This practice was soon communicated through this country; it was then the curl first made its appearance here, about seventeen years ago, which in very few years after proved highly injurious to this country in general.

I was very desirous, by any means, to find out the remedy, which caused me to try every experiment I could think of; but all to no purpose, till the year 1785, which was a very dry summer: I had then planted, in a field, an acre; I happened to cover them, when set, so that there was no mould left for the second earthing.

About the end of July, I saw several persons trying these potatoes from kind plants, with bells, or apples come to perfection; but no signs of any young potatoes at the root. It was a general report that there would be no crop that year, accordingly I went to try my own: some I found without any, and some with young potatoes, about the size of walnuts; but, as is generally the case, soon after the season altered, and became moist and rainy for a considerable time, which caused every cultivator to earth and tend his crops in hopes of success, but, as I mentioned before, I had not the conveniency of earthing.

Yet, when digging time came, there was a very plentiful crop of very large potatoes produced; but my plants ripened much sooner, because they had not fresh nourishment by earthing, and were not half as large as most of my neighbours.

In 1786, when the potatoes came through the ground, it was reported in the country, that the potatoes were curled in general: I sold that year about one hundred and twenty bushels; but I found to my satisfaction, that my own, and all that I had sold, were as kind as ever. It was then I began to study how mine should escape the disease, it being so general through the country; I recollected I could not earth mine the preceding year, and that they were not grown to the size of others: I built upon that foundation, as that was the cause. It was soon reported that my potatoes proved well, by which means I was applied to, the following season, from a considerable distance, for seed; and being very attentive to the same form of cultivation, found myself in the same situation as the year before.

Thus, to satisfy my curiosity, I planted two rows: one I managed as I observed in my first accounts*; and one row, as described in page 85.

I preserved seed from both, keeping them separate until the ensuing season; when, to my great joy and satisfaction, found the plants from the former half-curled; the latter, free as before: then I was fully satisfied in my opinion.

I have since raised yearly from one hundred, to one hundred and forty bushels, which I have sold from sixpence to one shilling a bushel dearer than my neighbours: these have always proved well. Some of the names of those persons I sent you in my first certificate. Many persons took upon them to say that I pickled them, whilst others said that I plucked up the curls the year before; but their groundless reports gave me no concern; neither did any one know my method, till I sent in my account to the Society in November last. But, in the mean while, I observed how my neighbours managed theirs; which was always a proof that served me for experiment and which supported my opinion.

I had then set some large potatoes whole, one or two of which produced very kind plants, and curled, which amazed me much. I got the potatoe tenderly up, and found two curled plants from the two sets, next the butt-end, and all the rest kind: this caused me to try my best experiment on the occasion; I observed the infection was only in the largest; I imagined the sap or vegetative power decreased from the butt-end as it grew larger, and consequently must increase towards the crown point. I I had then a plat, part of which I dug about the middle of September, another part in October; found they had increased in size: the rest I dug about the end of October, which were much larger than any of the two former: part of the largest of each digging I kept separate till the year following, which I planted whole, taking

* See page 84.

especial care, putting it down on paper, where every sort was set. When they came through the ground, I found the first dug all free from curl, the second produced plants both kind and curled, the latter were entirely curled.

Thus I found, if the season permitted, I could either cause them to curl or prevent it; accordingly, I sent an advertisement to Mr. Wood's, printer of the Shrewsbury paper, that a person had found out the cause and cure of the disease: I received no answer nor encouragement, till a friend sent to me a letter, wherein he signified the Society at the Adelphi.

I have sent, in my first account, in the year 1789, my whole discovery of the disease, from which I shall never vary, but shall add some few experiments I omitted in that first account.

Since I received the reward from the Society in May last, some of the leading gentlemen in my neighbourhood have desired anxiously to know my method; to whom I delivered it fully, and gained their approbation: they have since showed it to several persons, some of whom have told me that I have saved them the trouble of coming to me for seed any more.

I shall with the greatest pleasure lay down several experiments, which, I hope, will be to the satisfaction of the Society.

First, I will plant an acre with potatoes, especially if I may choose my situation, which shall prove kindly plants: I will manage as I shall think proper even every other row; the one half shall ripen, and die, three weeks before the other, while the rest shall be in a flourishing state: I will dig them up when I think proper; and the following year I will set some of both seeds, in the same manner; and the one half shall prove kind plants, and the rest greatly infected, even every other row, which shall be testified by credible witnesses.

Secondly, I think it proper to lay before you the cause of an infected crop proving more infected.

An infected crop is, perhaps, when one fourth are kind plants, and the rest all curled. The prudent cultivator endeavours to earth and nourish his poor crop, in order to make it as productive as possible: by that method the few kind plants being so far distant from each other, grow rank, and will produce a far larger sort than if they had been a full crop, as I have previously observed. I have observed, the cultivator carefully picks the largest for his seed, because they proceeded not from any curled sort: it is more than ten to one but they will be mostly curled when they next appear.

Thirdly, to prevent the curl, be careful not to earth nor meddle with them, except weeding: it had been better to have set the curled sort, which, as I have experienced, have proved kind.

Fourthly, why some curls appear in a crop that has been carefully managed.

Perhaps the soil might be richer in different parts of the field, or the manure laid on more plentifully: those potatoes will be larger, and consequently the sap or vegetative power will be decreased; then, when a few of those are cut amongst the seed, some curled plants will be produced. To avoid this, set none which exceed the average size, of any kind.

Fifthly, there is no foundation for saying, that the curl in potatoes arises from their being too long planted in the same ground: the method now used, is not to plant them more than one year in the same field, and that commonly on fallow; this I am certain is a sufficient change. I have now by me near two hundred bushels, which I will wholly forfeit if they do not produce a kind crop, with scarcely a curl among them, though planted in different sorts of land.

Sixthly, though the shoots should be cut; set the shoots and the sets, and I will affirm, if the set has its sap, both will prove kind; but if the set is corrupted, both will be curled.

"A good tree cannot bring forth evil fruit; neither can a corrupt tree bring forth good fruit."

Seventhly, I have experienced that the Old Winter Red, the long Americans, Pink Eyes, Pretty Bettys, the Early Dwarfs, the Black sort, the Golden Dabb, and several other sorts, have all curled; but further is needless to mention. Should I encourage the importation of fresh seed, I should not deem myself worthy of the Society's favour, nor capable of discovering the disease.

Eightly, to the curious, or those who have a mind to prove my experiment.

As I have endeavoured to show the cause and cure of the disease, I think it proper to lay it down with full directions. How to obtain a curly crop of potatoes. Set the beginning of June, not very thick in the row; manure well; earth them the usual time, do it repeatedly once in fourteen days, two or three times; let nothing browse them till the end of October; and when dug, pick the largest and preserve for seed; and if the season permits, I dare venture to promise a plentiful crop of curled potatoes.

Ninthly, when a dry summer, the ground well manured, with earthing co-operating, the cultivator must be very careful; for the above-mentioned observations are the real and only cause of bringing on the disease: but rich soil, having a southern aspect, even in a seasonable year, is equal to a dry summer in other situations.

SIR, *Berriew, January 19th*, 1791.

I have deferred answering your favour of the 28th of December last, until I had made a proper inquiry into the crops produced by the potatoes bought of Mr. Hollins, last year, for seed. I examined about twenty different persons, who bought their seed-potatoes of him, whether the crop was totally free from the curl; and their answers were unanimously in the affirmative. It was further asserted by several of them, that, having set the potatoes in fallow ground, the crop was entirely free from curl: whilst others who had set different sorts of potatoes in the same piece of ground, had them more or less curled.

With respect to the experiments, I have nothing to add. But I really believe that the circumstances related in his paper sent to the Society this year, are strictly true: that he could sell his potatoes from six-pence to twelve-pence a bushel more than his neighbours is a well-known fact.

The man who assisted Mr. Hollins to dig up his patatoes asserted that they were totally free from curl.

I am, sir, your very humble servant,
ROBERT WILLIAMS.

January 22d, 1791.

I do hereby certify, that I have, for three years last past, planted several bushels of Mr. Hollins's potatoes, and at the same time, in the same ground, and in the same manner as many of my own potatoes; that most of my potatoes were curled, and none of his.

PRICE JONES,
One of his Majesty's Justices of the Peace for the County of Montgomery.

XXII.—*On the Medicated Vapour Bath, invented by Mr.* CHARLES WHITLAW*.

No. 23, Finsbury Circus, Jan. 1, 1826.

THAT our health is deeply concerned in the care which we take in the selection of food, and even in circumstances generally overlooked by mankind, I have often stated. In my observations on the nature and properties of grasses

* From "A Letter to His Royal Highness the Duke of York, Patron, the Vice-Presidents, and the Committee, of the Asylum for the cure of Scrofula and Glandular diseases."

being deteriorated by weeds, particularly the butter-cup, I have been asked, "What becomes of the butter-cup after it has passed through the stomach of the cow?" Many facts, however, have confirmed me in my opinion of the danger proceeding from poisonous herbs: and among others I may present the following letter from Dr. Renwick to his Excellency Governor De Witt Clinton, directly bearing on the point; and those who inquire what effects are produced by the species of food which passes through the stomach of a cow, may be referred to every dairymaid in the country, on the effects of the turnip, and the different flavours of cheese varying in almost every country.

Copy of a Letter to His Excellency the Hon. De Witt Clinton, &c. &c. &c.; enclosing a specimen of a poisonous plant.

SIR, *Chillicothe, 25th July,* 1825.

This vine or weed, whatever it may be called, generally grows in low moist land, or round the edges of swamps, and perhaps is the most poisonous vegetable that grows; horses, cattle, and sheep feed on it in the fall; it very often proves fatal in a few hours. The first symptom is a trembling and weakness in the limbs. The cow that gives milk is not affected with it so long as she is regularly milked, but the milk is certain death to any animal, human or brute, that uses it to any extent; and the flesh of any animal that dies of it, also becomes fatal to the dog, the wolf, the eagle, or buzzard, that takes a full meal of it. The use of the milk has proved fatal to a great number of people living in the section of country called the Barrons, in this state, which lies between the Scioto and Big Miami. It would be very gratifying to them to know whether there could not be some antidote discovered against its poisonous effects.

I have the honour to be, &c.

FELIX RENWICK.

His excellency informed me, that, on a tour through the state of Ohio, he had learnt that the most dreadful effects were produced on many persons who used the milk of cattle which had fed on this plant. He requested me to ascertain its name and properties, that endeavours might be made to prevent its fatal effects. It proved to be the *rhus toxicodendron*; and on further enquiries in journeying from Albany to the Falls of Niagara, and in Upper Canada, I was informed, that infants at the breast had been poisoned through their mothers using the milk of cattle which had fed on the rhus, while the mothers themselves received no injury.

If I have trespassed too long in the preceding remarks, the importance of the subject will, I trust, plead my apology. I trust the following account of my proceedings in America during a year, commencing November, 1824, in addition to the success of my system for several years in this country, will be admitted as confirmatory of my opinions.

Previous to my leaving London in 1824, I addressed a letter to the committee for conducting the Asylum at Bayswater for the cure of Scrofula, stating my intention of revisiting America for the following purposes:—

"To insure a supply of the requisite medicinal herbs adequate to the increasing demand of the public, and to point out the situation, not easily communicated by writing, where they may be gathered in the greatest abundance, and in the highest perfection.

"Also to finish those practical experiments on the aphorisms of Linnæus, upon which I had for many years been engaged, and the completion of which will prove of the utmost importance to the human race."

With such views and intentions I arrived in New York early in November, and was not a little surprised to find the medical gentlemen there in determined opposition to my plans.

In this state of matters I proceeded to Washington, where I obtained a patent for my discoveries, and set about curing such patients as presented themselves, and succeeded in several desperate cases. The unexpected cures which I had the satisfaction to effect, attracted the attention of the president, and a considerable number of the members of the Senate and Congress,—and some of them became my patients. Their favour and support entitle those gentlemen to my warmest gratitude.

In the city of Washington a committee was formed who purchased my patent right in the bath, for the use of the public; of their first report the following is an extract.

WHITLAW'S VAPOUR BATH.

Report of the committee appointed by the subcribers for the purchase and use of Charles Whitlaw's Medicated Vapour Bath, at a general meeting of stockholders, convened at the Museum in Washington city, April 26, 1825; S. B. Barrell in the chair.

The committee appointed by the subscribers for purchasing Mr. Charles Whitlaw's medicated vapour bath, to superintend the use of the same in this city, conceive that the time is arrived when they ought to report more fully to the public what they have now learned from experience and observation, during the last two months, of the real use and efficacy of the Bath. They will detail nothing but facts that have come within their own knowledge, which, with some general observations on the nature of warm or vapour baths in general, and of the specific difference of this from other baths, and the regulations which have been adopted for its use in this city, will comprise all that they wish to say, until further experiments, shall have extended their knowledge of its powers and utility.

Since the bath was opened on the 10th of March, it has been used by fifty persons, of all ages from 7 years to 70, one hundred and twenty-four times. We believe that in all these cases it has been useful; but the most numerous class of cases in which it has afforded almost immediate relief, and, in several, complete cure, are those of recent colds, rheumatism, inflamed eyes, eruptions on the skin, scrofulous swellings, and general debility.

A considerable number of patients, whose eyes were so diseased that they had completely laid aside their usual avocations for many weeks, and suffered intense pain, so as to deprive them of sleep, and who had been subjected to the usual course of bleeding, blistering, and depletion by cathartics, in vain, have been effectually cured by the bath: in some cases, by three times using it, in others six or eight times. Some of these persons are citizens of great respectability, to whom a personal reference can be made. Dyspepsia, nervous irritability, and general debility, have been greatly relieved by it. Its efficacy in cases of irregular arterial action, whether it has been too rapid or too slow, has been strongly marked in several instances. In the former the pulse has been reduced, and in the latter increased; and in all cases a great equalization of the circulation, and lessening the tendency of the blood to the head, has been the speedy result of using the bath a very few times. It has a remarkable effect of clearing the skin from troublesome eruptions, and giving it a softness and freshness that is a striking indication of improved health. We have heard persons express their fears lest, in a state of great debility, it might prove injurious and dangerous. We can safely state that, to our knowledge, the weakestpersons who have used the bath have been strengthened by it; and we have not known a single instance in which the repeated use of it has not increased the vigour and activity of the patients. It doubtless requires some continued experience to prevent the possibility of its being misused; and that experience we are daily acquiring.

Thus far we can speak from our own knowledge, and several of the medical gentlemen of this city, who have advised their patients to use the bath, can vouch for the truth of some of these representations.

It is said, in the printed reports of the institution in London, where this practice originated, that the treatment with the bath, combined with vegetable decoctions, and a prescribed regimen, has been eminently successful in curing the most inveterate scrofulous ulcerations, diseases of the liver, dangerous quinsies, and croup, with many other formidable diseases. We doubt not that this may be the case, in the hands of skilful practitioners, and with a greater knowledge of vegetable remedies than we at present possess.

We pledge ourselves for nothing that we do not know: we are satisfied that we have conferred a substantial benefit on the city of Washington, by purchasing the patent right to use this mode of administering to the relief of human beings suffering under some grievous diseases. And we invite every regular practitioner of medicine in the city, to make use of our bath, under their own superintendance, upon such of their patients as they please, and to exercise their own judgment in the selection, and further experiment, of such herbs as they may judge most suitable to the diseases for which they are treated. We affect no mystery, nor aim at any monopoly, or opposition to regular practice. We have procured, at a considerable expense, *an additional means of applying well-known medicines, and producing certain results, in what we believe a safer, more direct and certainly a more agreeable way than is usual.* We only ask such a moderate remuneration for the use of the bath as will pay the expenses of its establishment, and gradually replace the capital we have advanced.

The use of warm, and even vapour baths, is nothing new. The practice has prevailed in all nations, and in all ages. The universality of this practice, as a daily luxury, among the Romans and the Asiatics, is known to every reader of history. Throughout Asia, and the northern coasts of Africa, *the vapours of herbs and spices are applied as the most delicious gratification*, as well as the means of health. The most celebrated physicians concur in stating the vast benefit of this practice, in raising the spirits, mending the pulse and appetite, and invigorating the whole frame. This has been experienced by thousands after severe fatigue, in old age, in tonic gout, and many other conditions of the human frame.

Vapour baths in this country have usually been the mere exposure of the body (except the head) to sulphureous exhalations, with a view to relieve rheumatic affections; or else the application of vapour, produced by a spirit lamp, to a patient in his bed, so as produce profuse perspiration. But this latter mode has been found exceedingly inconvenient, and, in some instances, highly dangerous, from the excessive damp imparted to the bed-clothes by the operation. Besides, it is evident that no other object can be affected in this way than merely exciting perspiration, and that without due regulation.

Mr. Whitlaw's vapour bath has not only decided advantages in these respects, but it attains other ends. Every one knows that *various plants possess highly important medical virtues*, and hence they are used in various infusions in all countries, for purposes in which experience has pointed out their efficacy. *In this bath, these herbs, properly prepared and preserved, are combined according to the object they are intended to effect. They are enclosed in a condensing box, beneath the tent in which the patient sits, and steam, at a high temperature, being forced upon them from an adjacent boiler, their essential oils are carried up in the form of vapour and fill the interior of the tent; which vapour not only acts upon the skin, but is inhaled by the lungs, and produces a grateful, but powerful effect on the whole system.* During the fifteen or twenty minutes which the patient remains in *this fragrant vapour* the perspiration flows copiously, and by constant wiping of the body the pores are opened and cleansed. After coming out of the bath it is necessary to use the aid of an assistant to wipe the body perfectly dry, with as much friction as possible; and, after dressing, to take the refreshment of a cup of coffee, remaining in the house half an hour or more, and then, in fine weather, a good brisk walk in the open air will not be attended with any danger, provided he be in sufficient health to enjoy it. Nothing more is necessary than to avoid a sudden chill from a cold draft of wind, or a damp atmosphere.

It has been doubted by professional men whether any effect could be produced on the viscera by the combination of the medicinal virtues of herbs with the blood, in its passage through the lungs, in the act of respiration. It is, however, known that important effects have been produced by vapour from mercury, sulphur, and other minerals; and we see no reason to doubt but persons possessed of medical science may, by a similar use of herbs, produce beneficial results in far more numerous and obstinate diseases than we are at present prepared to speak of. In the first access of bilious fever it may prove eminently useful. We request our physicians to make such experiments, and if they succeed in reaching some latent diseases by a method hitherto unknown or neglected, we are sure they will not reject the agent because it has not hitherto been in the regular course of practice. To give full effect to such experiments, the committee recommend that a small portable bath should be constructed, which will admit of its being conveyed to a sick chamber, at any hour, for patients whose disease is too violent to admit of their being brought out, and that such bath be at the disposal of any physician in the city, to be used for the benefit of his own patients, and immediately returned to the place appointed, for which a charge will be made not exceeding what is paid for the use of the public bath; and such remuneration as may be necessary for the agency of the male or female attendants who have been instructed in the mode of using the bath.

This explanation of the nature and present state of the Medicated Vapour Bath Institution, in the city of Washington, is respectfully submitted to the consideration of the stockholders, by THE COMMITTEE.

I leave the preceding report to speak for itself, and pass on to notice my visit to Charleston, in South Carolina, where I spent some time, and have particularly to acknowledge the kind and liberal reception I met with from several gentlemen of the faculty, and many other respectable persons. Here also it was my happiness to succeed in the cure of a number of persons, and the alleviation of others. In this city a company was formed, including five medical gentlemen, who purchased the patent use of my bath, and have established it on a very extensive plan.—The following is a copy of their first report, to which I have annexed copies of letters I have received from Drs. Holbrook and Shecut.

At a quarterly meeting of the Medicated Vapour Bath Company, it was unanimously resolved, that the following Report be published in the Gazettes of the city.

Extract from the minutes.

REPORT OF THE PHYSICIANS TO THE MEDICATED VAPOUR BATH DISPENSARY.

In conformity with the request of the board of directors, the physicians to the Medicated Vapour Bath Dispensary, with much pleasure, have drawn up a summary report, which they respectfully submit to the attention of the stockholders.

The important results from the application of simple as well as medicated vapour, in the treatment of certain chronic affections, having been attested by experience, within the United States, since its introduction, the following statement is intended to strengthen the confidence reposed.

The remarks submitted are the result of the observation of the medical directors, which includes the short period of scarce three months since its establishment. That no unqualified opinions may be promulgated on the treatment pursued in the dispensary, it is desirable it should be distinctly understood, that many of the cases enumerated were treated with internal remedies, and general directions given with regard to regimen, etc.; and all anomalous cases which obtained the use of the bath, have been excluded from this report; particularly certain acute diseases, in which decided advantage was derived. Such, whose cases were not permanent, must be attributed to the want of perseverance, and the unfrequency of its application; many have acknowledged relief from only three trials. During the period of eleven weeks, 236 persons were received in the bath, 120 of whom were patients of the dispensary; of the latter number, there were—of rheumatism 48, scrofula 6, debility 3, cutaneous eruptions 19, chronic hepatites 2, jaundice 1, dyspepsia 3, pulmonary affection 8, catarrh 7, dropsy 3, asthma 4, hæmoptosis 2, ulcers 4, leucorrhœ 1, intermittent fever 2, paralysis 3, hydrothorax 1, cynanche tonsylaris 3—Total 120. Cured 36, relieved 68, no relief 16—120. The remaining number, 16, includes anomalous cases, those yet under treatment, or those who came for pleasure.*

In no instance was it brought to the knowledge of the physicians that injury resulted from the use of the bath; and it is due to truth to state, that where no good was expected, invalids were apprised of its probable inefficacy.

The general diary or register of cases, contains a state-

* A case of country fever of seven days was cured by these applications of the bath during the present week, the patient being now convalescent.

ment of those who resorted to the bath as a preservation of health, by having removed from the surface of the body those depositions from the exhalations, that are productive of derangement, particularly in the cuticular functions. It will not be a digression to mention, as information to those unacquainted with the fact, the sympathy existing between the functions of the surface and the internal organs. On general principles, the medical directors are warranted in the assertion, that the judicious application of vapour is a good preservative of health, as well as a modifier of the violence of some troublesome affections.

From this statement a judgment may be formed, whether or not the support of the establishment will benefit the community. The encouragement already extended augurs in its favour—its success rests on its utility; should that fail, it can never be attributed to injury inflicted.

The medical directors are happy in communicating, that the generally received opinion still prevails that the institution has certainly been beneficial, thereby reflecting considerable credit on the exertions of those who united to bestow its benefits on the afflicted.

Copy of Dr. Holbrook's Letter to Mr. Whitlaw.

"DEAR SIR, *Charlestown, April 23, 1825.*

"Having attentively examined the effects of the *Medicated Vapour Bath* upon your patients, I feel it an act of justice to state, that whatever may have been my previous opinions, or, if you will, my prejudices, upon the subject of baths as a means of curing disease, I am constrained to allow, that the great and unexpected relief which has been experienced in a short time by the suffering and afflicted under your guidance, has gained my entire confidence: I have, in two days time, literally seen "the lame his crutch forego." The *complete* cures of long protracted cases of chronic disease, which now have every appearance of continuing, will render your invention highly acceptable to the medical profession, by removing from their hands a class of patients, of which they in general would be gladly freed. I have also been surprised at the sudden cures of several severely acute diseases, which you have effected during your residence in this city. Your new application of a long catalogue of remedies, heretofore neglected, has commenced a new era in the practice of medicine, and will hand your name down to future generations in the long list of worthies who have benefited the cause of humanity.

I am, with respect and esteem,

your sincere friend,

MOSES HOLBROOK, M. D.

S. M. C. A. Socius.

To Mr. Charles Whitlaw.

J. H. Duncan, M. D. concurs in the above opinions.

Copy of Dr. Shecut's Letter to Professor Mitchell.

DEAR SIR, *Charlestown, April* 21, 1825.

It has been my good fortune to be made acquainted with Mr. Charles Whitlaw, whose talents as a botanist are generally well known and appreciated in this country. I have also had an opportunity of investigating the principles, and, in several instances, of witnessing the effects of his invaluable Medicated Vapour Bath; and I am confident that those principles require no more than a candid and unprejudiced examination to render his practice acceptable to the scientific and humane, and adopted and used in the particular practice of physicians. The *modus operandi* of the process, and its effects in the particular diseases for which it is used, are no less rational than they are truly scientific; and as the vegetable kingdom affords to our *materia medica* an extensive choice in the different classes of their medical virtues, that have been tested by ages of experience,—if to convert the essential properties of those simples into vapour, and thus to cause the inhalation of those vapours to effect the relief or cure of individuals labouring under disease, be an innovation upon the science of medicine, so also must every recent chemical product, and every new formula offered as a remedy; be deemed likewise an innovation.

I am aware, my dear sir, of the important necessity of guarding against imposition in the practice of medicine; but I am qualified to say, that an acquaintance with Mr. Whitlaw, and an accurate investigation of the principles of his discovery, and the rationale of his practice, must eventuate in the decided approbation of every liberal practitioner, and of every friend to humanity; and with myself I am inclined to believe, they will cheerfully hail him as among the greatest benefactors of our country.

As this gentleman is on the eve of his departure for your city, I have availed myself of the opportunity of addressing you on the subject, conscious of the very great pleasure you experience in facilitating the views and promoting the designs of the humane and benevolent; and as the encouragement of this practice promises the greatest possible advantage to afflicted mortals, I cannot do otherwise than respectfully to urge to your attentive consideration the merits of this gentleman and his important invention. Permit me, at the same time, to apprise you of an advantage likely to result to our tropical cities from the use of this simple and elegant invention,—the prevention and cure of that fatal scourge to our population, the yellow fever.

Should the event justify the prediction, (and from the very nature of its application and effects it appears next to impossible to fail, if timely and judiciously resorted to and applied), shall we not have abundant reasons to class this indefatigable friend to science and humanity with the immortal and lamented Howard, Valli, and other renowned benefactors of men.

It is my design to urge the adoption of this bath in the medical treatment of *yellow fever;* and I very sincerely believe, that with judicious management, it will be found capable of effecting the reduction of the first stages of that disease. I should also urge the propriety of alternating electrical friction, sparks and modified shocks, with the bath: in both cases, however, the stomach and bowels are to be previously evacuated.

Be pleased, my dear sir, to pardon the length of this letter; the importance of the subject, however, will, I am certain, be its best apology with you. At the same time I must entreat your forgiveness for the great lapse of time that has passed since I last wrote to you. Incessantly occupied with electrical practice, and the formation of a new system of electricity, reducing it to a regular science, demanding almost every spare moment, will, with you, plead strongly in extenuation of my seeming neglect. I need not, I presume, say more to convince you of the sentiments of esteem and regard I have ever entertained for you, and pray you to accept the cordial salutation of,

My dear sir, your's most respectfully,

R. E. W. S. SHECUT.

To Professor SAMUEL L. MITCHELL, *New York*.

Copy of Dr. Shecut's Letter to Mr. Whitlaw.

DEAR SIR, *Charlestown, June 27th*, 1825.

Your friendly letter of the 4th instant has been received, and has afforded me sincere pleasure in communicating to me your very flattering prospects in the great metropolis of infant America. Of this I have never suffered myself to entertain a doubt, from the moment you did me the pleasure of explaining the principles of your bath, and of permitting me to investigate the grounds of your practice.

In this city the friends of "Whitlaw's Medicated Vapour Bath" are increasing daily: prejudices are fast yielding to stubborn facts; and I now distinguish, among its well wishers and its patrons, those who not long since condemned it as "a mere catch-penny juggle." I regret that I cannot furnish you with an official account of the success of the dispensary in this city; the medical directors are at this time preparing to lay before the company such an account: it would therefore be premature to attempt to furnish such a document before it has been officially examined and approved by the board. I am qualified to say to you, however, that it has lost none of the reputation you annexed to it, and promises much permanent good to the citizens, who are becoming more and more convinced of its safety and its utility.

Upwards of three hundred cases have been submitted to the operation of the bath; and many of these cases have been directed to it by the most eminent of the profession, and I think have already considerably lessened their prejudice. I am happy in finding such liberality; because it is a principle which ought to be inseparable from men of science. You will doubtless soon see the report of the medical board in its official form, and I should have delayed this until I could have forwarded it to you, but as my particular friend, Mr. Martin, has politely tendered to deliver you a letter from me, I have availed myself of the liberty, and take leave to introduce him to you on his tour through the northern states. Be pleased, my dear sir, to accept for yourself, and for your good lady, the assurance of my very sincere esteem, together with my best wishes for your success and happiness.

Yours, very respectfully,

To Mr. Charles Whitlaw. R. E. W. S. Shecut.

P. S. Drs. Holbrook and De la Motta have requested to be mentioned to you: the former gentleman would have written, but has so many engagements at present as to deprive him of that pleasure.

From Charleston I returned to New York, where I found the public opinion not only changed, but that many respectable persons appeared much interested in the accounts they had received of my success in the cities of Washington and Charleston; and so great was the desire for making trial of my remedies, that, within three weeks time, two hundred and twenty-four patients were introduced to my attention. A bath company was here also formed. His excellency Governor De Witt Clinton (who had received personal benefit from the bath,) was the first to subscribe, and was followed by Judge Herttell, and many other respectable persons, with seven doctors.

I was equally successful in the establishment of baths in Albany, where his excellency the Governor again headed the subscription, and was followed by General Van Ranselier, and Judge Spencer the Mayor. Here also six gentlemen of the faculty united with them. Baths were also established at Hudson, New Lebanon, and Wetervleit, and preparations for the same purpose are making in Troy and Lancingburgh, in the state of New York.

Copy of a Letter from Drs. Lawrence and Henrickson.

WORTHY FRIEND, *New Lebanon, May* 21, 1825.

Having made a thorough trial of the medicated vapour bath for four months past, in our societies in New Lebanon and Watervliet, we think it but justice to state, that we consider it an invaluable improvement in the healing art. Its power in reducing both chronic and acute inflammation, also in removing spasm, is certainly very great. In cases of obstructed perspiration, it is unquestionably the safest and best remedy that we have ever seen. Several persons in our society, who were scarcely free from a catarrhal affection during most of the winter months for several years past, have found permament relief by using the bath a few times, and the predisposition to take cold, as it is commonly termed, seems to be wholly removed. Obstructed perspiration is certainly, in our changeable climate, one of the most fruitful sources of disease; and any remedy that is capable of removing the predisposition to it, must be considered a great blessing to mankind; and as such we do not hesitate to recommend the medicated vapour bath, when used according to your directions, as a scientific and rational remedy in various diseases. Accept the assurances of our best wishes for your welfare.

GARRET K. LAWRENCE, M.D.
ABRAM HENRICKSON, M.D.

To Mr. CHARLES WHITLAW, *New York.*

Previous to my leaving New York, the committee of the Vapour Bath Company requested the seven medical gentleman who superintended the bath, to send in a report of their respective cases, for the quarter ending 1st October, 1825, the number, and the various diseases with which they were afflicted.

The following is a copy of Dr. William Ireland's cases.

Out of the number of cases submitted to the bath, 227 have been cured; and it is but justice to state, that in acute and chronic inflammation, more benefit has been derived from the use of the medicated vspour bath in twenty-four hours, than I have ever witnessed in a month's most successful practice.

The following is a list of the disorders included in the above 227 cases.

Obstinate visceral obstruction.
Acute and chronic affections of the liver.
Scorbutic diseases of the skin.
Scabies and old inveterate cutaneous disease.
Scald-head, salt-rheums, ring-worms, &c. &c.
Jaundice, lumbago, sciatica.
Acute and chronic rheumatism.
Asthmatic diseases, spitting of blood.
Palpitations of the heart, attended with weak small intermitting pulse.
Obstinate diarrhœa.
Erysipelatous inflammations, opthalmia.
Obstinate glandular and scrofulous diseases.
Obstructions of urine and menses.
Strangury, spasmodic strictures, &c. &c.
Syphilitic sore throat, eruptions of the skin.

Nodes, ulcers, &c. &c.

Tic douloureux, and nervous irritability.

In addition to the long catalouge of diseases enumerated by the medical practitioners, permit me to name a few more which came immediately under my own peculiar treatment, and wherein no instance of death occurred,—on the contrary, I left them either perfectly cured or convalescent. The disorders I allude to are the following:—atony of the muscles, atonic gout, elephantiasis, cholera morbus, cholera spasmodica, quinsy, croup, hooping-cough, measles, and gout.

In Philadelphia, the baths were established under the superintendance of four highly respectable medical gentlemen: and my most grateful acknowledgements are due to Mr. Watson the mayor, Mr. Haines, and other gentlemen, to whose kindness and liberality I am greatly indebted.

I paid a short visit to the city of Boston, where my system was most favourably received; Dr. Ingalls received me with the kindness of former friendship, and introduced me to Doctors Reynolds and Jeffries.

I have imported from North America an abundant supply of plants, all gathered in their native places of growth, both for the purposes of medicine, and my medicated vapour baths; and which are prepared and packed in a peculiar manner, well calculated to retain their full physical powers unimpaired for a considerable length of time.

We have ourselves witnessed the powerful effects of Mr. Whitlaw's judicious, though simple arrangement, in his medicated vapour bath, upon a scientific friend of ours, who took the benefit of it in a case of catarrhal fever, in inducing a most copious perspiration, from which he experienced great relief; and, by a repetition thereof, was completely cured.—EDITOR.

Mr. Whitlaw recommends the following plan of diet and regimen:—

Unwholesome food, impure water, and irregularities in diet, being the primary causes of most chronic diseases, it is necessary that patients afflicted with those disorders should pay the strictest attention to their mode of living, not only during the progress of cure, but even afterwards, as the same causes that produce a disease will occasion its return.

Breakfast.—Cocoa, chocolate, coffee, sassafras, or British herb tea, home-baked bread, or oat-cake, sweet butter, honey or eggs. Oatmeal porridge and milk, rice and milk, pearl barley and milk, or arrow-root. Water-cress, mustard and cress, radishes or scurvy-grass. But bread adulterated with potatoes and alum, rancid butter, and China tea, are prohibited.

Dinner.—The lean of animal food, well done; poultry game, fish and shell-fish; green and white pease, French and Windsor beans, cabbage, cauliflower, brocoli, Scotch kale, turnips, spinach, beet-root, asparagus, artichoke, vegetable marrow, celery, dandelion, carrots, parsnips, leeks, onions, garlick, lettuce, endive, nasturtium. Puddings composed of milk, eggs, sugar, flour or rice, sago, tapioca, arrow-root or other farinaceous vegetables. Toast-water or American spruce-beer. But pork, the fat of meat, ducks, geese, and eels, rich highly-seasoned soups and gravies; salt and salt meat, and *potatoes**; wine, cider, perry and malt liquors, are prohibited.

Supper.—The same as breakfast.

Fruit.—Acidity in the stomach being one of the most prominent symptoms of derangement of the digestive organs, the patients must abstain from fruit; especially from currants, gooseberries, grapes, plums, cherries, oranges, lemons, dried currants, raisins, and prunes; from vinegar,

* We cannot exactly agree with Mr. Whitlaw in his dislike to the *potatoe*. He attributes deleterious qualities to it; which, however, we should conceive are removed by properly cooking it.—EDITOR.

pickles, and acids of all kinds. But strawberries, raspberries, blackberries, mulberries, figs, apricots, peaches, nectarines, apples, and pears, may be eaten in small quantity when perfectly ripe and fresh gathered.

Water.—Water is the natural diluent and solvent of the food, and constitutes the chief part of the fluids of the body: *rain* or *river water* being lightest, softest, and purest, is the best; and *when filtered through charcoal,* should be used for drinking, and for all culinary purposes. But water containing putrescent animal and vegetable matter, hard pump, or well water, chalybeate springs, or water impregnated with iron, and water contaminated with the oxide of lead, in consequence of passing through leaden pipes, and remaining in leaden cisterns, is very deleterious, particularly in cases of scrofula and consumption, and therefore to be avoided.

Air and Exercise.—To promote the cure, it is indispensably necessary that patients, and particularly those afflicted with scrofula, who are frequently averse to active exertion, should rise early and take as much exercise in the open air as can be borne without pain or excessive fatigue.

The medicated vapour bath is a powerful auxiliary in the cure of the above-mentioned diseases. The effects of the vapour bath are:—

1st. To equalize the circulation of the blood, and hence to remove coldness of the hands and feet, and to lessen the determination or flow of blood to the head.

2nd. To promote sweat, and re-establish insensible perspiration, and thereby to relieve symptons of internal inflammation.

3rd. To diminish nervous irritability, and remove spasms.

4th. To promote cutaneous eruptions, and remove diseases of the skin.

5th. To remove the effects of mercury from the system.

6th. To promote absorption of dropsical effusions.

7th. To relieve difficulty of breathing, and hence to cure asthma, and other diseases of the chest and lungs.

8th. To strengthen the stomach, and impart tone to the digestive organs.

9th. To promote the healing of scrofulous and chronic ulcers.

10th. To remove gouty and rheumatic pains and swellings from the joints.

XXII.—*On the Tools proper for Turning Wrought-Iron in the Lathe, and the manner of using them. By the* EDITOR.

(Continued from page 5.)

WITH FIGURES.

SINCE the publication of the article in our last number on the above important subject, we have been favoured with a visit from an English engineer, who has resided in France for several years, and who, on seeing our description of the several turning-tools, some of which were new to him, thought it desirable to add to them one which he had employed for ten years in that country, with the greatest advantage.

On a Circular Nail-head Turning Tool.

He stated that he formed this tool by *upsetting* one end of a round rod of cast-steel, and which, when properly shaped, and hardened and tempered, he used by covering the top of his lathe-rest with brass, in order to prevent injury to the edge of the tool, which was rolled slowly along the rest, in rough-turning iron cylinders, and thus *it continually presented a new edge to the work, until it had made a complete revolution!*

This, as nearly as we can recollect, is all the information he afforded us; it was, however, fully sufficient to awaken our attention to the many advantages it possessed over most other tools of this description; and, accordingly, we have taken some pains to show how such a tool may be made with great facility and perfection.

In plate III. A, fig. 3, is a representation of one of these tools, as applied in use: B a circle, representing the cylinder to be turned by it: and C the top of the lathe-rest, with a plate of brass affixed upon it by screws. Fig. 4 represents a side view of a portion of the cylindrical body B, and of the lathe-rest C; and also a back view of the turning-tool A, taken at right angles to its flat face; the arrow upon it, and the dotted lines, showing its progress as rolled along the top of the rest.

From these figures, no difficulty can arise in comprehending the nature and manner of applying this excellent tool in use. We have now to point out what we conceive to be an advantageous process for making it.

It is evident that the *circular form* given to this tool admits of *its being turned into shape, and finished with great facility in the lathe*, an advantage possessed but by few turning-tools. We would, however, recommend that a tool, known in nail-making by the name of a *bore*, should be provided, both for the purpose of readily giving it form, and also improving its quality in the forging of it. This tool may either be held in the hand, as in the manufacture of nails, or still better be fixed or wedged securely in the anvil, in a dove-tailed and tapering groove, made across its face, as is usual in the anvils employed for many branches of manufacture; and also over a hole made through that part of the anvil adjoining to the *beak-iron*, to admit the stem or shank of the turning-tool, as will be understood on referring to fig. 5, where D is a section of the *bore*, or hollow tool; E a section of part of the anvil; F the hole through it; and A the circular turning tool placed in the *bore*.

The *bore* is formed of a block of steel, forged nearly to shape, and driven whilst red-hot into the dove-tail groove in the anvil, over the hole in it: a round hole is then to be punched in the *bore*, and its figure at top given to it, by means of a steel punch, with a shoulder on it, which is to be turned in the lathe to a proper shape, and hardened, being driven into it; the *bore* is then to be removed from the anvil, and be hardened for use.

Having then *upset*, or thickened one end of a cast-steel cylindrical rod or bar, by hammering it while red-hot, until a sufficient portion of the thickened end will remain above the top of the bore when fitted into it, to allow of forming the turning-tool; we then spread it with the hammer uniformly all round upon the top of the *bore*, till it approaches to a proper thickness to form the head of the tool, but still remains too thick; it must then be annealed in the manner we have before recommended, namely, by heating it just short of the hardening heat, and quenching it; it must then again be placed in the *bore*, and the forging be finished *by hammer-hardening it cold, to condense its pores.* Lastly, it is again to be annealed in the same manner, and is then ready to be turned in the lathe to its exact shape, as shown in fig. 1.

Previous to this operation, however, a central hole, shown by dotted lines in that figure, should be made in it, to steady it in the lathe; after which its face should be turned flat, and its back be formed of the shape shown, with an edge also made nearly sharp all around its head. It is now to be carefully hardened and tempered, and its edge to be finished to a proper sharpness in the lathe, by holding hones or whetstones of proper qualities and figures against it. It is now ready to be mounted into a proper handle or haft for use, in the manner already described.

This tool will admit of its edge being frequently refreshed or renewed in the lathe, in the manner described, before it will require to be again heated and spread out under the hammer, first out of and then in the *bore*, and then turned, hardened, &c. to renew it.

There can be no doubt but that the *square nail-headed* *turning tools*, described in the former part of this article, would also *be very considerably improved in their quality*, by being formed in a *square bore*, and treated by *hammer-hardening them cold*, as above directed for these *circular* ones.

We trust that the engineer from whom we received the information concerning these circular tools, will find our ideas concerning them to be correct; if not, we shall be much gratified by the favour of receiving more particular instructions from him respecting them, as he kindly intimated.

(To be continued.)

XXIV.—*Some Account of* PESTALOZZI, *and his System of Education.*

As Pestalozzi's system of education seems now to be likely to be established, at least in the United States, our readers may possibly be gratified with the following notice of him, which we extract from the *Athenæum*, a work edited by the late celebrated John Aikin, M. D.

The new method of instruction, as it is called, which is said to be invented by Pestalozzi, has excited considerable attention on the continent for several years past. Some of the sovereigns have sent confidential persons to the institutions established at different places, for the purpose of taking cognizance of the plan, and inumerable publications have issued from the German press, both for and against the particular merits of this alledged discovery. Like all such subjects of controversy, the advantages and defects of this mode of education have been mutually over-rated and concealed, and it is now left to be appreciated by the fair test of time and experience. After removing from place to place, and encountering various difficulties and persecutions, Pestalozzi is now settled at the pleasant town of Yverdun, in the Pays de Vaud, whither he removed from Buchsée, in the canton of Bern, in the summer of the year 1805. The government of the canton of Vaud has allowed him to take the *chateau*, formerly the residence of the bailiff, for his school, and he there hopes to realize his favourite schemes for improving the education of his countrymen. Pestalozzi is one of those self-taught men endowed with extraordinary genius, whose vast designs and projects dazzle and confound the judgments of their contemporaries. His mode of instruction does not seem to differ materially from what is followed by all village school-mistresses, all the initiators into the *literæ humaniores* of this and every other country. The theory of this good old practice is detailed in many high-sounding words, borrowed from the present fashionable German school of philosophy, and it resembles that of Rousseau, as described in his Emile. The object, we are told, is to teach children by *intuition*, which is looked upon as the foundation of all our knowledge, and the best mode for developing the powers of the mind in the most natural way. It consists in forming the child's judgment by addressing the sense of sight, and by beginning with the most simple and intelligible objects gradually to advance to those which are more complicated, yet have some relation with those already learned.

Henry Pestalozzi is the son of a surgeon-apothecary, and was born at Zurich in 1746. His father died when he was between four and five years old, and his education was superintended by his mother and one female servant. Having but little intercourse with any body out of his own house, he seldom met with children of his own age, and partook very little of their amusements. He thus grew up almost wholly deprived of favourable opportunities for acquiring the manners and knowledge of the world, by frequent converse with persons of different conditions in life. This mode of living naturally rendered him ignorant and careless of external appearances: and his neglect of his person has often injured him in the opinion of those who judged only by his exterior. However, from his earliest years he directed his attention to literary pursuits. He had the good fortune to study under several celebrated men at Zurich, when freedom of inquiry, a patriotic love of liberty and of the fine arts, shone forth there in full splendour; but the knowledge which he then acquired was not calculated to supply the defects of his education at home. He showed a decided inclination for an active life, and when he was seventeen he quitted his studies with the intention of devoting himself to the bar, but the death of an intimate friend, who was to have been his guide, induced him to renounce this plan, and to turn his attention to agriculture. He wished to become an advocate, in order that he might afford more effectual assistance to the degraded and neglected peasantry, by having his interference in their behalf regulated by a knowledge of the laws; and it was the desire of helping the same people in the same way, by having a thorough knowledge of their real situation and absolute wants, which led him to become a farmer. In consequence of this determination he purchased a large tract of land, in partnership with one of the first mercantile houses in Zurich. At the very time he was about to commence his operations this house separated from him, and he found himself left to his own resources. He did not suffer himself to be disheartened by this disappointment, but carried on his project with great spirit, and in 1775 he joined to it an attempt to educate the children of the poor. This new scheme, however, did not succeed.

In one of his letters to his friend Gessner he says, "I lived for years in the midst of a circle of upwards of fifty children, whose parents were in the greatest misery. In my poverty I shared my bread with them: I lived myself like a beggar, in order to teach beggars to live like men. My idea of the kind of education which I ought to give them comprehended agriculture, manufactures, and trade. I was fully satisfied with the efficiency of the plan I had formed, and I really still do not think I am mistaken; but it is not less true that I was deficient in the knowledge of detail in these three branches, and I wanted a mind capable of attending to minutiæ, which are inseparable from such a plan; besides, I was not sufficiently rich, and I was too destitute to be able to obtain the necessary supplies. My enterprise miscarried; but amidst the inexpressible efforts which I made, I learnt innumerable truths, and I was never more firmly convinced of the goodness of my project than when I found myself obliged to abandon it."

The check which this first attempt met with, plunged Pestalozzi into great distress; but his mind rose above his misfortunes, and he resolved to point out and to remedy the source of the misery among the lower orders of people, which he had become better acquainted with than any body else. With this view he published several books, of which the first was a popular novel called, "Leonard and Gertrude," which produced very great effect. It contains a history of the mode of life among the Swiss peasantry; and shows the ill consequences of vice, and the advantages of industrious and virtuous habits. In 1782 he published "Christopher and Else;" afterwards an Helvetic address to the inhabitants of the country. In the following year he wrote a treatise on the criminal code, and particularly upon infanticide; and in 1797 he published the beginning of his "Enquiries into the Natural Progress of the Developement of the Faculties of Man." He was obliged to contract the sphere of his exertions, but never lost sight of the great object of his life. At length he resolved to become a schoolmaster; he began his labours in this capacity at Stanz in 1798, but the troubles of the revolution and the horrors of war which broke out in the little cantons compelled him to relinquish this situation. The Helvetic government interested itself in the fate of his new institution at Berthoud and its founder, and a report highly favourable to the establishment was presented to the diet. A pension was granted to Pestalozzi, and promises of support, besides giving him an exclusive privilege of printing his elementary books. After the Helvetic government was overturned, the acts of those enlightened patriots were disregarded, and the deputies sent to the diet received no more instructions about the institution at Berthoud. Surrounded by several distinguished teachers, Pestalozzi deemed it prudent to divide the school; to take one half of the scholars to Yverdun, and to leave the rest under the superintendance of some able assistants at Buchsée. He does not seek to enrich himself, for whatever money he gets, he spends it in cloathing and maintaining orphans and poor children. At one time he had one hundred and ten scholars, most of whom were orphans and children abandoned by their parents whom he had collected together, whilst the rest paid him very badly, or at least in a very irregular manner.

In the month of June, 1805, I visited the school at Yverdun, and was present at an examination of some of the scholars. Five boys were called from their play, and were exercised and examined by one of the senior scholars and one of the teachers in a variety of arithmetical, algebraical, and mathematical questions, on purpose to satisfy my curiosity as a stranger. They answered all the questions, which were put to them with great accuracy, and were not puzzled with questions not very easy of solution which were asked by indifferent persons. One of them, a fine looking boy, between seven and eight years old, resolved several complicated problems with the sagacity and correctness of a college student. They answered these questions by working the whole of the numerical relations in their own minds, without the help of pen or ink, or pencil, or any cyphers; but in those which were the most complicated they referred to tables with lines and points dotted on them, which are employed to show the relations of different quantities. The advantages of this method seem to consist in the use of analysis, by habituating the mind to analyse and trace the series of consequences in any given process, and to refer all the ideas of relation to the impressions made by the sense of sight. It also may serve to increase the power of attention, and to lead young people to attend to sensible objects rather than to abstract notions. For all those studies which depend chiefly upon the sensations of sight it seems well adapted, as for instance, drawing and design. To this department it has been applied, and some specimens were exhibited which did credit to the pupils. They are first taught to draw straight lines, and to represent crystals of different forms, and then to draw from the skeleton and human subject. The bones of the arm, pelvis, and jaw were well drawn with a pencil, and portraits of two school-fellows neatly executed.

However well this method of conveying instruction may be calculated to form philosophical minds, it appears doubtful how far it will tend to increase the powers of judgment, or prepare men for the common business of life. May not the reasoning faculty be too early called forth? may not the imagination and the sensibility of youth be deadened and destroyed? and that promptitude for action on great emergencies be lost and frittered away by the slow and cautious practice of reasoning and deduction? Pestalozzi intends to apply the same mode for teaching geography, natural history, and other sciences: he considers his plan still in its infancy. His scholars are taught the languages and writing in the usual way; they speak both German and French. The boarders pay 25*l.* per annum. No corporal punishment is allowed. The boys are all much attached to their masters, and the school appears to be upon a very good footing. There is some resemblance in the general outlines of this plan for instructing children and that of Joseph Lancaster, but they differ in many essential particulars. Both of them have the same laudable object, the improvement of the human race. Those who are anxious to enquire farther into the detail of Pestalozzi's plan, may satisfy their curiosity by reading a book entitled "Exposê de la Méthod Elémentaire de H. Pestalozzi, par D. A. Chavannes, M. D. à Vevey, 1805;" or by referring to the "*Jena Zeitung,*" and especially to one of Pestalozzi's works, called "*Wie Gertrude ihre Kiuder lehrt,* &c."

XXV.—*On Ærial Navigation. By a Correspondent.*

WITH A FIGURE.

SIR, *Cork, January* 14, 1826.

THE study of nature will always afford hints for the perfection of art; yet it is wonderful, that, in the attempts to improve aerial navigation, the structure of birds should have presented useful hints in vain. In birds, light bones are always found, which give attachment to the muscles of motion, and propagate any impulse from the wings, to the entire body. Something analogous to the bones of birds, for instance, hollow rods, or tubes, combining strength and lightness, are absolutely necessary in balloons, to propagate any impulse from oars or wings, to the entire system.

Oars or wings, attached to an oscillating car, which is connected with a balloon above by ropes alone, can never be of service. Although a car may be suspended by ropes from a platform, supported by a number of balloons; yet hollow rods, to connect the platform with the car below are necessary for propagating any impulse.

In the *Technical Repository*,* I have directed attention to the advantage of working wings or oars and a rudder attached to such a platform, from a car below, by means of cords; and have shown that these oars may be of great size, if supported by separate balloons. That, by this arrangement, balloons may be propelled in calm weather, will, I think, be admitted. As some of the aeronauts may be induced to try this new plan, if adapted

* Vol. VII. pages 172, and 236.

to the present form of balloons, without materially altering their usual arrangements: I shall attempt to describe a mode for this purpose.

The car is to be suspended *in the usual manner, from a large balloon by ropes,* but a strong hollow rod rises like a mast, from the car, up through the gas, to the centre of the balloon, where it joins a rod that goes across, and out through the balloon at each side. To each end of this cross rod a wing is articulated. The wings, which present a flat or concave surface underneath*, are supported by gas, contained in hemispherical silk coverings. The gas in each wing communicates through the articulations and the hollow tubes, with a condensing apparatus placed in the car. By this means gas may be drawn from one wing to make it counterbalance the other wing exactly. The aeronauts, from the car, can work these wings by cords, and the impulse will be propagated by the rods to the entire system. The vertical rod and the horizontal rod inside, in the balloon, may be strengthened by two additional hollow rods, placed obliquely, which form, with the two first rods, two triangles, inside, in the gas. The wings, supported by gas, may be of vast size; and the aeronauts, pulling the cords, will, from the resistance of the air to the extended surface of the wings, have a good purchase to work upon. In descending, the wings spread out will act as a parachute, and will ensure the easy descent of the entire apparatus. A rod, crossing the first horizontal one at right angles, inside, in the balloon, will serve for the attachment of a bowsprit, and for the articulation of a rudder; the weight of which can be supported by gas, in the same manner as the wings.

It was once attempted to form a society in London for the encouragement of aerial navigation; but it is better, first to have a satisfactory theory for the guidance of balloons, previous to embarking in expensive experiments. I offer the above hints for the candid criticism

* See plate IV. fig. 8.

of those interrested in the progress of aerial navigation: their pointing out errors, may lead to new views; their approval of the theory, might lead to actual experiment.

When once ascertained that a large balloon of the present form could be acted on by wings, no doubt attempts might soon be made, to prepel a platform, supported by a number of balloons. The aeronauts in the car, by means of cords and pulleys, could make the oars, articulated to the platform, to strike the air in a horizontal direction. The supporting of oars and wings by means of gas will lead to unexpected results in aerial navigation.

I shall now describe some contrivances for securing the balloon on its descent; the aeronaut should be provided with a long rod, which I shall call the *car rod;* a rope is bound to it, along its entire length, with thread; one end is furnished with a spear-pointed, barbed iron head. With this rod, he can tear the balloon, to allow the gas to escape rapidly, if in danger of being blown out to sea; with it he can prevent the car from being dashed against a tree or building. He can grapple bushes with it, when skimming near the ground; and can break the violence of the shock in descending. If by breaking the shock the rod is snapped, the barbed iron which enters the ground, is secured to the rope bound to the side of the rod, and serves as an anchor.

A contrivance, somewhat similar to the common gin, or snare, pointing downwards, and placed at the bottom of the car, could be easily made to snap and take hold, when the car touches the ground. This would be an imitation of the claws of birds; and would, I have no doubt, be found of great service.

I shall shortly return to this interesting subject again; mean time, I remain,

Sir, your obedient servant,

To T. Gill, Esq. J. M. S.

XXVI.—*On the Cultivation of the Silk-worm.* By JOHN MURRAY, F.L.S. &c. &c.*

SILK is the production of different species of larvæ, or caterpillars. The spider's web appears to be of the nature of silk. Bon, a Frenchman, obtained several pairs of stockings from the webs of a particular kind of spider, and even recommended their cultivation,—but they made war on each other, and the idea was of necessity abandoned. At the same time, the webs of some spiders are tolerably strong—that of the *aranea avicularia* sufficiently so to catch small birds, as the *trochilus*, or humming-bird. I recollect having seen, in the British Museum, a small painting, the *canvas* of which was a spider's web. A silky substance is frequently found in the vegetable kingdom, lining the cavity where the seeds repose, or enveloping them in its folds. A silky tissue has likewise lately been discovered in the leaves of the mulberry.

The *phalena bombyx* is the insect most commonly propagated in Europe for silk; but the *Phalena Atlas* yields a greater quantity: there is a wild insect in the woods of India, described by Bewick, and other naturalists, which yields a species of silk. Some years ago, a quantity of a very peculiar kind, obtained probably from a similar source, was sent to this country; it was of a *fawn colour*, or of a texture not unlike that of a mixture of silk and worsted. Such, at least, is the specimen I obtained from a silk manufacturer at Macclesfield, who informed me that it was manufactured, still preserving the native colour, and was eagerly purchased. I am not aware that more than one parcel has ever been imported into England.

Calmet remarks that the Greeks and Romans had but a very imperfect knowledge of the nature of silk. Virgil uses the expression, "vellera serum"—the *cocoons of the silk-worm*; and Lipsius, in his notes on Tacitus, says, "Byssina e lino, bombycina e verme," &c. The Latin

* From a Treatise, published by him in November last, and communicated to us recently.

sericum, silk, may either be supposed to be derived from the Hebrew word SERIKOTH, from a root, signifying *yellowish tawny*, the natural colour of the raw silk generally; or from *SERES*, a nation, whence the Greeks and Romans first obtained it. Hence Hesiod, (l. xix. c. 27) "*Sericum* dictum, quid id *Seres* primi miserunt;" and Servius, (in Virg. Georgic, b. II. x. 120,) "Apud Indos et Seras sunt quidem in arboribus vermes, et bombyces appellantur, qui in areanearum morem, tenuissima fila deducunt. Unde est sericum," &c.

The silk-worm appears to be a native of China, and feeds on the leaves of the mulberry; and I found every where in Italy a decided preference given to the *white* mulberry. The Chinese seem to have been acquainted with the culture and manufacture of silk from a very remote period; but it was scarcely known in Europe before the age of Augustus. This beautiful substance soon attracted the notice of the luxurious Romans,—and became a common article of dress after the effeminate reign of Heliogabalus. It was brought from China at a very considerable expense; and, after being manufactured by the Phenicians, was sold at Rome for its *weight in gold.* By the conquests of the Scythians, this commerce was interrupted in the reign of Justinian; and all attempts to restore it failed, till two Persian monks, bribed for this purpose, concealing the eggs of the silk-worm in hollow canes, brought them from China to Constantinople, where they were carefully propagated. This was in 555, and we find some years afterwards, that the Greeks had learned the art of cultivating and manufacturing it. Roger, King of Sicily, introduced the manufacture of silk into that kingdom, about the year 1130, by forcibly carrying off the silk weavers from Greece to Sicily. From thence the art of cultivating and managing the silk passed into Italy, afterwards into France, and, on the revocation of the edict of Nantz, a manufactory was established in Great Britain.

(*To be continued.*)

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since Dec. 27, 1825.

To John M'Curdy, of Cecil-street, Strand, in the county of Middlesex, Esq., for certain improvements in generating Steam. Dated Dec. 27, 1825.—To be specified in six months.

To James Oyston and James Thomas Bell, of Davies-street, Berkeley-square, in the county of Middlesex, watchmakers; who, in consequence of a communication made to them by a certain foreigner residing abroad, are in possession of certain improvements in the construction or manufacture of watches of different descriptions. Dated Jan. 6, 1826.

To Richard Evans, of Bread-street and Queen-street, Cheapside, coffee-merchant; for certain improvements in the apparatus for, and process of distillation. Dated Jan. 7, 1826.—In six months.

To Henry Houldsworth, jun. of Manchester, in the county of Lancaster, cotton-spinner; for certain improvements in machinery for giving the taking up, or winding on motion to spools, or bobbins, and tubes, or other instruments, on which the roving or thread is wound, in roving, spinning, and twisting machines. Dated Jan. 16, 1826.

To Benjamin Newmarch, of Cheltenham, in the county of Gloucester, Esq.; for an improved method of exploding fire-arms. Dated Jan. 16, 1826.—In six months.

To John Rothwell, of Manchester, in the county of Lancaster, tape manufacturer; for an improved heald, or harness, for weaving. Dated Jan. 16, 1826.—In two months.

To Henry Anthony Koymans, of Warnford-court, Throgmorton-street, in the city of London, merchant; who, in consequence of certain communications made to him by a certain foreigner residing abroad, is in possession of certain improvements in the construction and use of apparatus and works for inland navigation. Dated Jan. 16, 1826.—In six months.

To John Frederick Smith, of Dunstan Hall, Chesterfield, in the county of Derby, Esq.; for an improvement in the process of drawing, roving, spinning, and doubling wool, cotton, and other fibrous substances. Dated Jan. 19, 1826.—In six months.

To William Whitfield, of Birmingham, in the county of Warwick, for certain improvements in making or manufacturing of handles for saucepans, kettles, and other culinary vessels, and also tea kettle handle straps, and other articles. Dated Jan. 17, 1826.—In six months.

To Benjamin Cook, of Birmingham, in the county of Warwick, brass-founder; for certain improvements in making or constructing hinges, of various descriptions. Dated Jan. 19, 1826.—In six months.

To Abraham Robert Corent, of Gottenburgh, in the kingdom of Sweden, merchant; at present residing in King-street, Cheapside, in the city of London; for a method of applying steam, without pressure, to pans, boilers, coppers, stills, pipes, and machinery, in order to produce, transmit, and regulate various temperatures of heat, in the several processes of boiling, distilling, evaporating, inspissating, drying, and warming; and also to produce power. Dated Jan. 19, 1826.—In six months.

To Sir Robert Seppings, Knight, a commissioner and surveyor of our navy, of Somerset House, in the county of Middlesex; for an improved construction of such masts and bowsprits as are generally known by the names of made masts, and made bowsprits. Dated Jan. 19, 1826.—In two months.

To Robert Stephenson, of Bridge Town, in the parish of Old Stratford, in the county of Warwick, engineer; for his axletrees to remedy the extra friction on curves to waggons, carts, cars, and carriages, used, or to be used, on rail-roads, railways, and other public roads. Dated Jan. 23, 1826. In six months.

THE

TECHNICAL REPOSITORY.

XXVII.—*On a mode of preparing Etching-ground for Engravers. By Mr.* EDMUND TURRELL, *of Clarendon-square, Somers-town*.*

THERE are few articles of more importance to copper-plate engravers than the compound commonly called etching-ground. This observation need not be enforced by any practical illustration, as all engravers have at one time or another had sufficient experience to establish the fact.

As there are many recipes in existence, and several of them almost equally good, it is very difficult to make choice without considerable experience, and even then, however judiciously the materials may be proportioned, yet failure may take place, from the bad qualities of the ingredients, or an improper method of compounding them.

The first object of this paper will be to describe the several materials in their genuine state, together with their characteristic properties.

Secondly, the best method of compounding them, and also their general proportions: with rules for varying the same as occasion may require.

The most important and indispensable material is asphaltum. I believe there is no substance in nature that can completely supply its place; and, indeed, however good all the other materials may be, if this one is bad

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

nothing can be added to make up for its impurity. Asphaltum, or Jews' pitch, is a solid mineral bitumen, supposed by many naturalists to have originated from fluid petroleum, or mineral tar, inspissated by some natural process of evaporation.

The tar that is obtained in the distillation of bituminous coal, by the common process of preparing coal gas, bears a considerable resemblance to petroleum, and if properly treated, by gentle evaporation, first forms a complete mineral pitch, and, by a continuance of the process of evaporation, it at last attains the consistence of asphaltum. This artificial asphaltum is found to answer nearly all the purposes of the natural production, as an ingredient in the coarse black varnishes, such as are used for coach tops, and a variety of japanned wares, such as coal-scuttles, and most of the common iron articles that are required to be preserved from rust by the application of common and cheap varnish.

The artificial asphaltum has a fracture so nearly resembling the natural, that it is very difficult to distinguish them by mere external inspection; yet, generally speaking, the former is of a deeper black colour than the latter, the best of the natural kind being of a fine deep dark brown colour: it is used frequently as a glazing colour in oil painting, and is likewise said to be the article which constitutes the basis of the cake colour used in water colour painting, and known by the name of Vandyke brown. If a small piece of the artificial asphaltum be laid upon a hot iron, the vapour will be very nearly the same as that produced from a piece of coal placed in a similar situation, and a coaly cinder will remain behind.

The most certain method of detecting the natural from the factitious is by the smell.

The products that arise with the tar, in the distillation of coal, and are more or less combined with it, are sulphur and ammonia; which substances, although very volatile in their pure state, have so strong an attraction for the tar as by no means completely to separate from it during its conversion into the artificial asphaltum; therefore, when we submit this substance to the test of hot iron, the ascending vapour has always a nauseous odour, in which both sulphur and ammonia may be distinguished.

The presence of these substances in the artificial asphaltum made from coals, evidently renders it very unfit for the purpose of making etching ground; because, as dilute nitrous acid is used to corrode the copper plate, in the process of *biting-in*, the well known affinity of the acid for the alkali will cause a decomposition of the etching-ground, and shallow or rough bitings will be the consequence. I shall also add, that etching ground, made of such asphaltum, will sometimes act slightly upon the copper-plate, if the ground should be left upon it for a considerable length of time, and a stain will be produced upon the surface, productive, in some cases, of much evil in the process of *biting-in*. I trust these observations will be deemed sufficient reasons why the artificial asphaltum should be rejected in making etching-ground.

When a small piece of genuine Syrian asphaltum is placed upon a hot iron, it will, if it be very good and pure, be nearly all converted into vapour, the smell of which is by many persons considered to be agreeable. The essential oil of turpentine dissolves it completely, and forms a liquid varnish that resists the action of dilute nitrous acid. Hence some engravers use it to cover the etched lines on copper plates that have been sufficiently corroded by the nitrous acid in the process of biting-in. I have frequently observed, that the atmosphere does not act upon the surface of pure asphaltum to decompose it, and perhaps it is on this account that it appears to have been so largely used in the composition employed to cover the mummies of the Egyptians.

The above-mentioned properties that pure asphaltum possesses, of resisting the action of dilute nitrous acid, and also of giving hardness and toughness to etching-ground, render it completely indispensable, and consequently an ingredient of the very first importance.

The second, and scarcely less important substance, is Burgundy pitch. This is obtained from the *pinus abies*, or Norway spruce-fir-tree. After the resinous matter is collected from the tree, which is by incision, it is boiled in water, and strained through a linen cloth, and packed in casks or bladders for exportation. It is chiefly prepared in the neighbourhood of Neufchatel, and comes to this country through Saxony.

The best for making etching-ground is sold in bladders, and when perfectly good is of an opaque yellow, rather darker than straw colour. By age it becomes superficially transparent, and at the same time, probably by the loss of its essential oil, becomes so brittle as to be rubbed down between the fingers. That which is the most recent, and therefore opaque, is the best for the engraver's use, as it effects a more complete solution of the asphaltum.

The third and last article is virgin wax. That which is brought from the East Indies is, in general, the best. Most of the English wax is adulterated with deers' suet, which makes it very unfit for the purpose of making etching-ground, because it destroys the toughness and adhesion of the ground to the copper-plate. This adulteration may be very easily detected by its softness and clamminess to the feel, and also in its being less transparent when interposed between the eye and the light. If the surface of fine wax be rubbed with a linen cloth, it will take a considerable polish, or gloss, while that which is adulterated will be comparatively dull. If thin shavings are cut with a sharp clean knife from genuine wax, the edge of the knife will leave a fine polished surface where the shaving is separated; but wherever adulteration with suet has taken place, the polish will be proportionably wanting. As these three ingredients (when pure) are all that are necessary to make good etching-ground, I consider it quite useless to multiply the number. Asphaltum, it has been stated, is indispensable, and therefore must be had at any price. The other articles may be obtained without difficulty.

General directions for preparing and compounding the ingredients above named.

The asphaltum must be broken into small pieces, and if any pieces of clay or other impure matter are observed, they must be carefully taken out, and then it must be ground very fine in a marble or Wedgwood-ware mortar; and while it is under this process, if any hard stony material is discovered, it must be carefully taken out; it will then be ready to be mixed with the other materials, in the following manner.

Put four ounces of Burgundy pitch into a well glazed pipkin; let it melt gently over a slow fire, and move the pipkin round, so that the whole internal surface may be covered with the melted pitch. Then add four ounces of the ground asphaltum, and let the pipkin remain upon the fire until the two substances are tolerably well mixed, which will soon be effected if the mass be well stirred. Then add four ounces more of the asphaltum, and if the heat be increased, and the mass well stirred, the whole may be incorporated, and will be nearly as fluid as melted pitch.

When the asphaltum appears to be thoroughly melted, it should be kept in that state for at least a quarter of an hour, the heat being a little lowered, but it must be stirred all the while, by which means a large portion of the moisture of the Burgundy pitch will be evaporated; and the essential oil of the pitch will be thoroughly incorporated with the asphaltum, and render the etching-ground more perfect; for, when this is omitted, evaporation takes place from the ground when spread upon the plate, after it has been laid on for a month or more, and sometimes in a shorter time, a circumstance which very often produces considerable difficulty to engravers, because when that takes place, the ground is rendered brittle, and frequently chips or flies from the plate, to the great detriment of the tints or lines ruled upon it. When the asphaltum and Burgundy pitch are thus prepared and incorporated, add six ounces of the best virgin wax, and keep the whole well stirred till it is completely mixed, and let it simmer gently for about ten minutes, when it may be taken from the fire, and suffered to cool until it is of the consistence of turpentine, or very thick treacle, and in that state it may be poured out upon the clean surface of a copper-plate, or well glazed earthenware dish, in portions sufficient to make a ball, which may in general weigh about an ounce, and when it is sufficiently cold, it must be rolled up into balls by the hands, and kept perfectly clean for use, provided it is found upon trial to be of the proper consistence, but this cannot be judged of until it has been laid upon the plate for a few hours. If it is too soft the etching point will make the lines of unequal breadth, or, as they are technically called, will be drag-lines, being in some parts very fine, and in others very gouty or thick. If it is too hard, the etching point will cause the lines ruled on the ground to chip, and then the edges will be notched or serrated, which would be very prejudicial to the appearance of fine even tints.

There is also another property that may be wanting where the proportions are not properly adjusted, namely, that of spreading kindly on the copper-plate. This fault in ground may be easily remedied, by the addition of a proper quantity of Burgundy pitch.

As each of the evil qualities above-named are likely to happen, on account of the different properties of the materials: and as, on that account, *general principles* or directions will be much more acceptable than mere arbitrary recipes, I shall now endeavour to lay down such *general rules*, that when either of the faults before described occur it may be immediately remedied.

In the first place, asphaltum makes the ground hard and tough, therefore if it wants that quality, more asphaltum must be added, but it must be previously dissolved in a proper proportion of Burgundy pitch, for otherwise it will be very difficult, if not almost impossible to get it thoroughly incorporated, after the virgin wax has been added. The propriety of this caution will be evident, when it is considered that Burgundy pitch is the *real solvent* for the asphaltum, and must therefore at all times be incorporated with it first; and for this reason it will always be the best way to make the ground rather too hard than too soft, because it is much easier to soften it than to make it harder.

Should the ground, upon trial, be found too hard, a small quantity of virgin wax may be added, which is all that is necessary to answer that purpose.

If, upon trying to lay it upon the copper-plate, it does not spread kindly, but clings to the dabber, and only partially covers the surface of the copper, this fault may be remedied by adding a small quantity of Burgundy pitch; but should this property prevail, and the ground also appear upon trial too soft, then Burgundy pitch and asphaltum must both be added, after they have been thoroughly incorporated together; for the principal circumstance to be attended to in making etching ground, is completely to dissolve the asphaltum; for although all the recipes I have read or heard of direct the Burgundy pitch to be added *last*, yet I am convinced, from much experience, that as Burgundy pitch is the true solvent for asphaltum, these two ingredients should be first thoroughly mixed, by which means only can the real and beneficial effects of the asphaltum be fully obtained.

From what has been stated above, the following general rules or principles are deduced:

First, that asphaltum gives hardness and toughness to etching ground, and is indispensably necessary, on account of its valuable property of resisting the action of dilute nitrous acid.

Secondly, that Burgundy pitch acts as a perfect solvent for the asphaltum; and, when mixed, acts also as a vehicle to spread the ground over the surface of the copper-plate; a property essentially necessary to prevent foul biting.

Thirdly, that virgin wax assists in softening the ground, and giving it such a consistence, that when lines are cut through it by the etching point, the edges of each line will be extremely clear and free from flaws or chips, which would be destructive of the beauty expected from the etchings of the present improved state of the art of engraving.

I beg leave to observe, in conclusion, that my principal object in this communication, is to lay before my brother artists the result of several years experience, gained by careful practice, rather than submit to them novel experiments or arbitrary recipes which fix no useful or general principles in the mind, without which every attempt to modify or alter the composition, must be attended with uncertainty, and too frequently with disappointment.

XXVIII.—*On the Tools proper for Turning Wrought-iron in the Lathe, and the manner of using them.* By *the* EDITOR.

(Continued from page 116.)

WITH A PLATE.

WE have been favoured by a scientific friend, Mr. Duncan Campbell of Alfred-place, who is an amateur mechanic of many years standing, with an account of the following turning tools, which he has long used with great satisfaction.

Of the oblique Spike-head Tool.

The first is a *spike-head* tool, which differs from the one described by us in page 2, in its end being formed *oblique* and not square. This tool is represented in fig. 1 of plate V. which is a top view of it; and by fig. 2, which is a side view of it. This construction enables the workman to place its cutting edge in a more favourable position for use, than can be obtained with the square ended tool.

The round-ended Spike-head Tool.

This tool has its end formed into a semi-cylinder; as shown in fig. 3, and is hollowed on each side, as shown in fig. 4; it thus constitutes another variety of the ***hook-tool***, somewhat similar to those described in page 2, but with two cutting edges, and without their pointed heels; and is a very serviceable and readily formed tool, either for roughing out work, or for turning hollows in it.

Another straight-edged Hook-tool.

This tool answers the purpose of the tool described in page 4, and shown in fig. 14 of plate I. being employed in finishing cylindrical surfaces. Fig. 5 is a top view of it, fig. 6 a side view, and fig. 7 an end view of it. The inside of it is ground true, as far as shown in fig. 5; and its end ground sharp, as shown at *a a a*, in figs. 6 and 7. Both its angular lower edges are jagged with a chisel, as shown at *b b b*, in order to enable it to penetrate the ***copper-plate*** with which the top of the lathe-rest is covered, and thus prevent the tool from slipping away from its work. This tool is about seven and a half inches long in its stem, and is securely fixed into a wooden haft, eighteen inches in length. It and the following tool are not to be tempered, but to be left quite hard.

Another angular-edged Hook-tool.

This is indeed a ***valuable tool*** for ***rough-turning*** either ***wrought-iron*** or ***brass***, but it must be used in a proper manner, and which we shall endeavour to describe.

This tool is formed much in the manner of that last described; but, instead of its edge being straight, the end of it is ground into two slightly rounded faces, meeting at the point in an angle. Fig. 8 is a top view of the tool, fig. 9 a side view of it, and fig. 10 an end view of it. Both its angular lower edges are jagged, for the reason above given. In order to convey an idea of the manner of holding it in use, we have added fig. 11, which is a top view, and fig. 12, which is a side view of the tool *c*; the lathe-rest *d*, and the cylinder to be turned *e*. In both of these figures the tool is shown in an oblique position, in the first, as turned towards the left hand; and in the other, as held sloping from the perpendicular; these compound oblique positions are necessary to give the cutting edge *f* its due situation, in respect to the cylinder to be turned by it. The reader will please to observe that is is not the *angular point* of the tool which is here employed, as in the *common hook-tools*; but either of the rounded edges of it, *f* or *g*: in the present case, the edge *f*, as above described, is shown in use, and the tool securely and firmly resting upon the angular jagged edge below it, on the copper-plate forming the top of the rest. Its edge should be posited rather below than above the centre of the body to be turned by it; and its operation be made to resemble the cut of the ordinary *turning graver*, used by clock-makers and other experienced mechanics; that is, that the cutting edge *f* is held obliquely against the cylinder *e*, and thus producing a fair shaving or turning, in the manner of the *graver, when held in its most favourable position*; but this tool is greatly superior to the graver, in the *steadiness* with which it supports itself upon the top of the rest. We hope that we have rendered ourselves understood in this description, but it really requires a sight of the tool in use to obtain a proper idea of its superior excellence. In order to bring the face *g* into use, it is necessary to reverse the position of the tool, that is, to turn it to the right-hand, instead of towards the left, as here shown. A very little practice with a tool so formed, will, we hope, be sufficient to enable a workman to get into the *true manner of using it*; and we can promise him, that his endeavours will be well repaid, by the acquisition of a most invaluable turning tool. For brass the edges are to be made rather blunter than for wrought-iron.

Fig. 13 exhibits an improvement made by Mr. Campbell in the socket of his lathe-rest; viz. the addition of another screw below, by which he is enabled to bind the stem of his rest much more steadily in the socket than where, as at present, only one screw is employed.

(To be continued.)

XXIX.—*On the Culture of the Silk-worm.* *By* John Murray, *F. L. S. &c. &c.*

(Continued from page 126.)

The insect, from which silk is procured, reposes motionless for the period of nearly six months, in a minute round body called the *ovum*, or egg. From thence it springs, under the form of a little elongated animal with eight pairs of feet, a caterpillar, or *larva*. This caterpillar, improperly called silk-worm, feeds on the leaves of the mulberry. It increases rapidly in size; so much so, that its skin in six or seven days after birth cannot contain the internal organs. In its turn, this skin bursts,—and the little insect comes forth in a new dress, advancing towards another stage of maturity for seven days more. There are altogether, under this state of being, four distinct changes of skin.—When the silk-worm feels that it is about to quit its fifth skin, it looks out for a secure and retired situation, and there constructs a dormitory, where it may be safe from external contingencies. It then spins its silken web, disposing it in such a manner as to leave an oval cavity within. This ball is called the *cocoon*. The larva casts off its last skin in this abode, to become a being of another order, and altogether different from the appearance it had before assumed. In this singular form, in which it somewhat resembles a child in swaddling bands, it is called *crysalis, aurelia,* or *nympha.* In twenty days after the transformation of the larva or caterpillar into the crysalis or aurelia, entirely effected within the cavity of the silken cocoon, we may perceive, at length, a little insect, plumed with white wings, burst from the cocoon. This is the *imago,* or winged' state of the animal, called phalena, or moth—the most perfect state of this strange microcosm. The moth soon lays eggs: these (about six months after) in their turn, again produce larvæ. This larva spins the cocoon, and the same interesting circle of changes is thus repeated.

Henrietta Rhodes, in a communication to the "Society of arts, manufactures, and commerce," says, that a fibre of silk, unwound from the cocooon, extends 404 yards: when dry it weighs three grains. One lb. avoirdupois is equal to 535 miles in length, and 47 lbs. would thus encircle the globe. The silk, as spun by the insect, is in the form of fine threads, or fibres, which vary in colour, from white to reddish yellow. It is very elastic, possessing considerable strength, and covered with varnish, to which its elasticity may be imputed. This varnish being soluble in boiling water, but insoluble in alcohol, has somewhat of the nature of gum, or perhaps rather of a nature intermediate between *gum* and *gelatine.* The silk imported from China is always *white,* and apparently of a stronger, rougher, and coarser consistency than that from Bengal, which is yellow. The Italian silk is generally yellow.

It seems very strange that the cultivation of the silk has hitherto been so limited in Europe, from an absurd notion that the climate, in particular localities, is unfavourable. By Count Dandolo's process, however, we manage the treatment with as much, or greater certainty, than we do the cultivation of grapes for the market; and what a curious and interesting appendage might not this form to the stoves and conservatories in gentlemen's gardens, where the artificial heat that serves for the exotic plants, would exactly suit the culture of the silk-worm, and where, too, a few mulberry trees might be forced, in pots, or boxes,—(See Mr. Knight's observations on the mulberry in the transactions of the Horticultural Society of London) —contemporaneous with the evolutions of the insect to meet its infant wants, till the open ground, about the 1st of June, would furnish a sufficient supply? The whole process occupying only 36 or 37 days, or little more than a month. There is another consideration deserving particular attention,—and that is the probability of *naturalizing* the silk-worm, and obtaining a hardier brood. Great Britain differs not more from France and Italy, than these do from the Oriental climes, whence the silk-worm first sprung, and where it is indigenous. The *Aucuba Japonica, Corchorus Japonica,* and other congeners, have, in this country, been once the inmates of the greenhouse, but they are now found to grow luxuriantly in the open ground, and in situations the most exposed. The same thing may be said of the *Camelia Japonica**, did their expense not preclude the experiment. Be this reasonable speculation of *naturalization* as it may, we can introduce the silk-worms into an *artificial climate,* and manage them with most complete success.

At Sion, last summer, I had a good deal of interesting conversation, on the subject of the silk-worm, with Mons. George d'Escher de Berg, Jun., Chateau de Berg, near Schaffhausen on the Rhine. I acknowledge myself much indebted to his intelligence and courtesy†. He informed me, that the cultivation of the silk-worm was introduced with growing success into Oberland, under the auspices of an Agrarian Society at Zurich, of which he is an honorary member. He added, *inter alia,* that they were *indebted to the north of Italy* for the supply of leaves of the mulberry to feed the insect in its earliest stage of growth. I

* Even in the case of the *Pine apple,* as Mr. Knight has shown, in the Trans. L. H. S. we have been *too profuse* of our artificial temperature.

† M. d'Escher de Berg informed me, that he had made trials with the *Phormium tenax,* or New Zealand Flax, in his garden.

explained to him Count Dandolo's method of culture; which he exceedingly admired, and suggested a trial of the leaves preserved in close vessels to the exclusion of air—the powder of the dried leaves—and, finally, forcing a few pots of mulberries by artificial heat, or by covering the plants with awnings, &c.

The eggs are at first strewed on shallow trays of paper of a convenient size. Brown paper, or white laid wire paper is decidedly the best, since that which has undergone the destructive process of bleaching might prove injurious, if not fatal. The mulberry leaves, (those of the *white* mulberry are by far preferable), are at first chopped small, and strewed over the trays. The caterpillar is, in its second, or third stage, &c. transferred to larger and more commodious trays, and an increased supply of food given, proportioned to their size. At first, the compartment is small, then the caterpillar is removed to rooms of a larger size; while the heat, at first, about 72 deg. F. gradually declines to 69 deg.

The cocoons, when intended for silk, are thrown into boiling water, to destroy the included *nympha*, and then carefully dried by a stove heat, or in an oven. Those intended for the future crop are strewed over a coarse linen cloth, extended on a table in an unused room. It is stated that an *obscure* or darkened room is best adapted for this purpose; and the habits of the family of the *Phalenæ* seem to sanction the conclusion. From each pound of cocoons, (male and female), according to the principles stated by Count Dandolo, *two ounces of ova* may be obtained; whereas he mentions, as comporting with his knowledge, that, from bad management, in many parts of the country, not unfrequently 10, 20, and even 30 lbs. of cocoons, have been sacrificed for a single ounce of eggs. When the extremities of the cocoon remain less abundantly supplied with silk, and it is confusedly disposed, the concealed *nympha* within may be considered perfect and sound.

The female *nymphæ* weigh about twice as much as the males, and thus the female, all circumstances being alike, ought to be larger than the male cocoons. The other modes of discrimination are equivocal or fallacious, and even this test is only to be considered as a general guide or approximation to truth. One hundred males weigh seventeen hundred grains, and one hundred females three thousand grains. A proper number of each being selected, the cocoons intended for the production of the moths are placed on the cloth, (as before mentioned), in a room, the temperature of which does not exceed 72 degrees F.—a higher temperature, though it might cause their earlier evolution, would injure their healthiness; and if the principles of the Count are adhered to, the cocoons will be always healthy. Stillness and decreased light will be found favourable circumstances. The moths having deposited their eggs on the coarse cloth prepared for this purpose, soon die; the ova adhere by a gummy matter to the cloth. The temperature is reduced to about 66 degs. F.; and when the ova, after remaining a few days, have acquired an *ash colour*, the cloth extended on a frame may thus be removed to a cool apartment, where it is necessary they should be preserved *dry*. The eggs when required are easily detached by immersing the cloth in fresh water, which dissolves the mucilage, and they are then carefully and properly dried.

The obtainment of the silk from the cocoons, consists in collecting the various threads, winding them on reels, taking care that the cocoons severally unwind freely through all their extent. In order the more easily to obtain this end, the cocoons are thrown into caldrons containing water heated to nearly the point of boiling. The various threads are then collected together by means of a whisk or brush, and are thus attached to a reel, passing through plates of steel, &c. being wound by particular machinery attached to a water-wheel. When the water is pure, and the more it is preserved clean in the boiler, so much the more beautiful and abundant is the product, because the water otherwise becomes discoloured, from the decomposition of the crysalidæ that fall to the bottom.—Gensoul of Italy, has invented an apparatus, by means of which the water is heated through the medium of steam, and the nymphæ that fall are collected on a grating of iron wire at the bottom of the boilers, which is frequently raised for the purpose of removing the husks. By this ingenious method much fuel is saved, one furnace with its boiler serving to heat twenty vessels, and from the decreased temperature the cocoons do not suffer any decomposition or change, as is the case in the ordinary way, wherein they are immediately exposed to the direct agency of the fire. Another saving might still be effected by this method, in the substitution of vessels or cisterns of wood for boilers of copper. In the month of August last, at Buffalora, on the Milanese frontier, I visited an establishment for unwinding the silk. Women were arranged in two rooms, opposite each other, and conducted the process. The cocoons contained in baskets on one side were thrown by handfulls into caldrons of water, kept boiling by charcoal fires beneath. Each by a *whisk* (of peeled birch) collected the threads *en masse*, the first confused portions were rejected, till the threads unwound regularly, freely passing over glass rods to prevent the injuries of friction. The first portions are necessarily useless, and are separated by the hand. When the threads came off uniformly, the cocoons were raised suspended to the hand by their respective threads, and thus handed over to those on the opposite side, who, in their turn, threw them into caldrons of water, the temperature of which was nearly that of blood heat, and more than milk warm—thus sustained by a steam-pipe.—The water was thus kept clean, and the silk preserved pure and unsoiled. From these the threads were finally wound. The proprietor informed me that this establishment cost 60,000 francs.

Those cocoons that are white, or of a very light yellow, are esteemed the best. The cocoons are required to be kept in boiling water about three hours, (*steam,* I should think, by far the safest mode, and decomposition would be prevented), to kill the nymphæ within. The leaves of the *white* mulberry are preferred, and will cost on an average about two soldi the libra grosso.

The young mulberries in Piedmont are generally defended by *a rope of straw or hay twisted round the stem.*

At Novara, I was informed that sometimes nearly 100 lbs. of cocoons were obtained from the ounce of ova, and that this season proved favourable. There, the leaves cost about 1 soldo per lb.

At Varese, one ounce of ova was computed to yield from 45 to 60 lbs. of cocoons—5 lbs. of cocoons were estimated to produce 1 lb. of silk. One pound of silk thus obtained was stated to be worth 24 *lire Milanese.*—In one instance, I paid a franc for what weighed, on the 7th November, 46 grains, and another portion, which cost a franc and half, at Varese, weighed 175 grains. The ova seemed good, being mostly of an *ash colour,* and but few, comparatively, yellow grains. Four grains weight of mixed ash and yellow ova I ascertained contained 396 ova. One hundred ash, or impregnated ova, weighed .8 grains; one hundred yellowish or unimpregnated ova weighed .7 grains: so that each grain containing about 100, there will be in an ounce Troy about 48,000 ova.

On inquiry at Milan, on 6th of August, I was told that silk was dearer this year than last, owing to the chilling winds from the Alps, and wet, in the early part of the season. Last year, the raw silk cost 45 francs—the present year, it was valued at from 50 to 65 lire Milanese per lb. of 28 ounces. The white is always most esteemed. At Vicenza, much silk is cultivated, and besides its introduction into Swisserland, I was told that Hungary, &c. now boasted of the advantage. Almost all the silk cultivated in the Lombardo-Venetian kingdom is *sent to France to be manufactured!!*

When at Baveno, on the *Lago Majiore,* I was informed by the landlord of the inn where we resided, that he raised this season about 400 lbs. of cocoons, and that the year was a good one. They feed the silk-worm here also on the leaves of the white mulberry, which cost from 1 to 2 soldi per lb. *grosso.* Females, at this place, are in the habit of wearing the ova, for 2 or 3 days, wrapped up in cloth, next the skin. The *ova* here were estimated at 10 francs per ounce, and each ounce calculated to produce about 100 lb. (libra grosso di Milano). Almost every poor family rears the silk-worm; and on how magnificent a scale could they not be reared in the Isola Bella, where the artificial temperature is introduced on so extensive a scale, and where the luxuriance of exotic vegetation vies with that of tropical regions?

XXX.—*On Etching and Cleaning Alabaster.* *By Mr.* Henry Moore*.

SIR, *Green Hill, Derby, March* 16, 1825.

I send you an alabaster vase, ornamented by a process which I discovered some time ago, and by which process soiled alabaster sculptures may also be completely cleaned, and rendered equal to new. I beg you to lay the article before the Society for the encouragement of Arts, Manufactures and Commerce, together with the annexed account of the process by which the ornament is effected.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* Henry Moore.

Taking advantage of the well-known fact that gypsum, or alabaster, or sulphate of lime, (for these are only three names for the same thing), is perfectly soluble in 500 parts of cold water, Mr. Moore has adopted the following process.

* From Vol. XLIII. of the transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its large silver medal to Mr. Moore, for his invention.

He covers the ornament, and all those parts that are not to be corroded, with a composition that will resist water. Wax, dissolved in spirits of turpentine, and mixed with white lead, may be used with a camel-hair pencil; or turpentine varnish, with a little animal oil and white lead, and will be found to work more freely than the wax. Spirits of turpentine must be used in pencilling with these compositions. The use of animal oil is to prevent the varnish from becoming very hard, which would render its removal, after corrosion, extremely difficult. The ornament, and other parts which are intended to be preserved, being completely covered with the composition, it is suffered to remain a few hours to dry. The article is then put into a vessel of rain water, in which it must remain 48 hours, or longer, according as the ornament may be required to have more or less relief. When the corrosion is completed, the varnish or wax must be removed with spirits of turpentine, which may be applied with a bit of sponge, and then be wiped off with soft rags.

The article, being made quite clean, is now rubbed over with a soft brush, dipped into finely-powdered plaster of Paris, and is applied in the dry state. This powder fills the pores of the corroded parts, giving a certain degree of opacity, similar to that which is left from the tools of the sculptor. It forms a good ground that contrasts well with the ornament, and makes it appear with greater advantage than if left merely in the corroded state.

The alabaster of which the vase is made was procured from a quarry at Chellaston, about four miles from Derby.

To clean Alabaster Sculptures.

Spots of grease are first to be removed with spirits of turpentine; the article is then immersed in water, where it is suffered to remain about ten minutes, or, perhaps, a little longer, if the thing be very dirty; it is then rubbed over with a painter's brush, suffered to dry, and then treated with plaster of Paris as above, when the article will be found perfectly clean, as if just from the hands of the sculptor.

A piece of sculpture that would take several days to clean by the usual way, with fish skin and Dutch rushes, is, by this process, completed in half in hour.

XXXI.—*On the Management of Hot-house Flues, so as to keep up a nearly equal Temperature during the Night. By the Rev.* George Swayne, *Corresponding Member of the London Horticultural Society*. With suggestions for the adoption of a similar Practice in the Warming of Stoves for Hatching Silk-worms, by the* Editor.

DEAR SIR, *Dyrham, Jan.* 14, 1825.

As often as I cast my eyes on the following admonitions† of my Gardening Directory‡, viz. "His last examination of the furnace for the evening should not be *earlier* than ten o'clock,"—"He ought to be again at the fire within seven hours of the leaving it,"—"Attend punctually to the furnace in the afternoon, *late* at night, and timely in the morning. Between five and nine in the forenoon, never let the course of fire-heat relax,"—I feel pity for those among the successors to the primitive employment of our first parents, who have to attend to the modern refinements now very generally attached to that employ, namely, the forcing department, and the culture of exotics. Whilst the rest of the servants of an establishment are usually enjoying themselves before a comfortable fire, at

* From Vol. VI. Part II. of the Society's Transactions.

† These admonitions refer to the method of heating stoves by *flues*; but that of heating by *steam* is not less subject to the inconvenience of night attendance, as I understand from a letter of Mr. James Dodds, (Vol. III. of the *Caledonian H. S.'s Memoirs*, page 124), addressed to Mr. Hay, the contriver of his apparatus, wherein he tells him, that, in order to keep up the heat of the house to sixty degrees he made up the fire under the boiler at 10 o'clock at night, and 6 o'clock in the morning; the substitution, therefore, for the former, however preferable in other respects, would not less break in upon the gardener's rest by night.

‡ "Abercrombie's Practical Gardener," by Mean, pages 612 and 13.

some of the above periods, and in their warm beds at others, the poor gardener is obliged to encounter the pitiless pelting of rain, snow, or hail, the cold pulses of the frosty air, or the piercing shafts of the northerly blasts, in regularly pacing to and from his furnace, (in many cases, no doubt, at a considerable distance from his lodgings), without the allowance of a single intermission during the tedious winter.

But surely these matters may be managed otherwise; *the common baking-oven,* after fuel has been burning therein about two hours, when the fire is removed, and the door closed, *retains a high degree of heat for twenty or thirty hours**! Although in the mean time, it had been somewhat cooled, by the evaporation from the bread in baking, as well as by the door standing open, whilst the same was being withdrawn: and although, (as in my case), the door be of iron, which, from its known conducting quality, rapidly transmits the heat into the atmosphere in contact with it. Why then do we not adopt the *ovenian principle,* (to borrow Mr. Jeremy Bentham's license), in our stoves and hot-houses, and by closing up the furnaces and flues, after they have been properly heated, at an early hour in the evening, and re-opening them, and re-kindling the fire at an hour not inconvenient in the morning, at once spare the gardener's rest and the master's coal-heap? But this closure, in order to be effective, must, I conceive, be air-tight, or nearly so; and therefore cannot be made with due effect by means of the common iron furnace doors; not even by the double doors with registers, now, I believe, pretty generally in use. Nor will iron slides, (or dampers, as they are commonly termed), be more efficient; for neither of these can be made to shut so close, but that air will pass through or around

* In attempting to measure the heat of my oven, on the morning after it had been heated in the middle of the preceding day, by placing therein a brewing thermometer, in the tube of which the mercury had the power of rising no higher than two hundred and ten degrees; the bulb, in a short time, burst. The heat, therefore, I think, must have exceeded that point. Having been so unfortunate, I did not make any further attempt.

them. And however well fitted we may suppose them to be at first, they will not (from the rough usage, as well as the alternate contraction and expansion, to which they are exposed in that situation), long continue so, but will soon become loose, and have vacuities around them. And whenever there is an aperture, even if that aperture be on the top of the chimney, a stream of cold air will continually descend on one side, whilst the warm is ascending on the other, till the flues, and the body of air contained therein, become of equal temperature with the superincumbent atmosphere. Some other contrivance, then, becomes necessary for this purpose, which, by common ingenuity will, in most cases, be found of difficult accomplishment.

I am possessed of a small experimental stove, I may call it a diminutive one, and that this epithet is not inappropriate, I think you will allow, when I state its dimensions to be only twelve feet nine inches in length, by somewhat less than ten feet in width, inside measure. In the management of this little stove, during the last winter, (the first of my possession of it), yielding to the prejudices of my gardening servant, I suffered him to follow the directions of his books, as well as the example of his brother practitioners in the neighbourhood, by making up a large fire in the furnace, just before bed time, then damping it down, as it is termed, with ashes on the top, and leaving the door more or less open, according to the motion of the air, or otherwise the draught of the furnace. In the morning the fire was sometimes just alive, so as to rekindle on being stirred, but more frequently it was wholly extinguished. But whether it was *in* or *out*, the temperature of the house was the same, and always very low, in accordance with that without doors. However, by other attentions, I contrived to keep the frost out, and to preserve a few pine plants, with a tolerably healthy appearance, through the winter.

But I was so very much dissatisfied with the furnace management, that I resolved, if I should live to see another winter, to put in execution the *ovenian* plan; which resolution, the perusal of Mr. Atkinson's paper on the management of furnaces*, in the mean time, tended in no small degree to confirm. Accordingly, in the month of September, I began to prepare for this new scheme of reform. First, I had the wall around the opening of the furnace and ash-hole, which had been left in a rough state, made plain and level with plaister. Next, I had to prepare a door for this opening, which would shut close, and at the same time resist the heat; being averse to the use of iron for this purpose, on account of its heat-conducting quality, I obtained from Bristol a large Welsh slate, sufficient to cover the whole. This slate was squared, fitted, and framed with good red deal, in the manner of a cyphering slate, but more substantially. The inside of the frame, (that which, when appplied as a door, was to press against the wall), was lined all round with thick cloth list. It was then slung in a pulley just over the fire-place, and balanced with a weight. In this state it was moveable up and down with the least exertion, and when drawn up was out of harm's way. When let down, it was pressed close to the wall by means of a bar, and then covered the whole of the furnace, and ash-hole beneath, air-tight.

The next thing was, to secure the other extremity—the chimney, which being topped with a chimney-pan, I had only to get a moveable cover to fit the latter. Here I could not, on account of the exposure to the weather, well dispense with the use of some metal, and therefore had an iron cap made for the pan, with a loop on its summit; a standard, of the same metal, was fixed in a stone beneath, on the top of which a cross-bar traversed on an axis, (in the manner of a weighing beam), with a hook on one end, on which the cap was hung. From the other end, which was nearly balanced by a leaden weight, a wire was ap-

* Horticultural Transactions, Vol. V. page 467; and Technical Repository, Vol. VIII. page 37.

pended, which reached to the fire-place, in the shed, by means of which the cover was moveable on and off at pleasure. To render this cover air-tight, as well as to obviate the conducting quality of the iron, it was lined with thick woollen cloth.

The management of this machinery is as follows: towards the evening, *i.e.* between seven and eight o'clock, the fire (not a large one) is made to burn briskly for about half an hour, when it has burnt clear, the slate is drawn down, and fixed to its place with the bar; in a few seconds the cover is let down on the top of the chimney; in this state they are both suffered to remain till eight o'clock the next morning, at which time the slate is drawn up to its place over the furnace; the ashes stirred out from amongst the cinders (or rather the charred coals) left in the grate over night, which should be done with a *wooden* stick, for the better preservation of the iron-work, and the ash-hole beneath cleansed of its contents. Then, and not before, for a reason to be mentioned presently, the cover is drawn up from the top of the chimney, and the fire is lighted. The fire is continued burning till eleven o'clock, (three hours), when the flue and furnace are closed again, till about four o'clock in the afternoon. They are then re-opened, the fire kindled, and kept in active combustion till about eight o'clock. By this management *the fire is in action less than one-third of the twenty-four hours*; consequently, *two-thirds of the fuel*, which would be necessarily expended in keeping the fire burning the whole of that period, *are saved*, as well as *all night attendance rendered unnecessary!*

But there is another *troublesome operation*, besides the night attendance, which this plan, if it does not entirely prevent, *renders of much less frequent occurrence; and that is, the cleaning of the flues. As two-thirds less fuel are consumed, the soot produced is of course diminished in the same proportion.* But it is not the soot only, or principally, that choaks the flues, but the ashes which are carried into them by the current of air whenever the fire is stirred, or the ash-hole emptied. These ashes collect in heaps, the heaviest of them just below the throat of the flue, and the lighter at the different angles. To prevent which, whenever the fire is stirred, or the ash-hole cleaned out, the cap should be previously let down on the chimney top for the moment. This instantly causes a recoil of the current of air, wich blows out of the mouth of the furnace those ashes which would otherwise bave been carried in, and have lodged in the flues. As soon as the dust raised by stirring the fire, &c. has subsided, the cap is to be drawn up again.

By the aid of this simple apparatus thus regulated, I have been enabled to keep up, in my little stove, through this winter, hitherto, a higher, more equable, and regular temperature, and with much less trouble and expense* than I could do in the last, when the furnace was supposed to be continually in action. At no time since last September has the fire been lighted before eight o'clock in the morning, or continued after eight in the evening. Nor is it my intention to alter this regulation, although the weather should become much colder than it has hitherto been†. The glazed roof of my stove is not puttied, and there is no tan in the pit, only a few common leaves on the top of it to the depth of the bottom of the pots, the latter resting on a foundation of drift-sand and coal-ashes.

It may deserve to be noticed, that in a few minutes after the current of air has been excluded from the flue in the evening, the thermometer suspended in the middle of the house begins to rise, and continues to do so from

* On my present plan, a quarter of a hundred weight of small coal, suffices for the consumption of the furnace during twenty-four hours, as I have ascertained, by weighing the quantity used in that space of time. The cost of which, estimated according to the price of that article, as stated by the President, Thomas Andrew Knight, Esq. in his paper, *on the most economical method of employing fuel, &c. (Hort. Trans.* Vol. IV. page 156), amounts to no more than 1½*d.*: but I rather think it costs me about double that sum.

† The thermometer out of doors, one morning, was at 4 degrees below freezing.

twenty to thirty minutes, during which time it rises from one to three degrees; after which, it becomes stationary for some time, and then gradually subsides, about one degree in an hour, till the morning. When I leave the stove at eight o'clock in the evening, it usually stands at from 65 to 70 degrees: in the morning, at the same hour, I commonly find it from 55 to 60 degrees. *Another good effect of the exclusion of the air from the flue is, that the latter very soon afterwards becomes nearly of an equal temperature throughout,* which is not the case whilst the air is passing through it.

An objection may possibly be made to the trouble of so many kindlings of the fire (twice a day); but if there be a provision made, and kept at hand, of materials proper for this purpose, such as a tinder-box, or a phosphorus bottle, matches, and some small faggots, of a proper size for the furnace, each made of a handful of dry sticks, with a few shavings or dry straw bound up with them, I presume this objection will be considered to have very little weight; for *the charred coals left in the grate at closing up, being warm, as well as dry, presently take fire, from the application of a very small quantity of ignited matter. The flue likewise being warm, a quick draught ensues, and blows up the fire in an instant.* In stoves situated at no greater distance than 50 or 60 yards from the dwelling house, the furnaces may be lighted, (as mine constantly is), by a shovel-full of live coals, taken from the bottom of the kitchen grate, without either wood or straw.

Very serious injury is frequently occasioned in stoves and hot-houses, by the flues getting overheated, from the wind unexpectedly rising high in the night, and accelerating the draught of the furnace, when no one is at hand to regulate it; or from the soot taking fire when the flues have been neglected to be cleaned in time. Under the above system, all accidents of this kind are effectually prevented from happening in the night. And should the soot take fire at any time by day, it may be presently extinguished by first taking the fire from the furnace grate, and then excluding the air, as above described.

I remain, &c.

To JOSEPH SABINE *Esq., Secretary.* GEORGE SWAYNE.

Suggestions on the employment of the above practice, in warming Stoves for hatching Silk-worms. By the EDITOR.

We know not whether the Rev. Mr. Swayne, who has written so ably on the culture of silk in this country*, has thought of applying this excellent practice to the heating of stoves for breeding silk-worms, which is now in such general use in Italy. It seems peculiarly adapted to this purpose, and the range of temperature he mentions is the proper one for hatching and bringing the worms to perfection. Its *great economy* must also particularly recommend it in a manufacture where we have to compete with foreigners under *such a vast disparity in point of wages*; and the little trouble it is attended with, and the great cleanliness of the stoves, must be additional circumstances its favour.

XXXII.—*On the Indian methods of working Iron and Steel, for the Damascus Gun-barrels and Sword-blades. By Capt.* MICHAEL EDWARD BAGNOLD *of Bombay*†.

DEAR SIR, *7, High Row, Knightsbridge, March 7, 1825.*

HAVING obtained, through the medium of my brother, Capt. Michael Edward Bagnold, of Bombay, the processes used in manufacturing gun-barrels and sword-blades at Damascus, with the peculiar method of tempering weapons used by the natives of India, I shall be happy to communicate the same to the public, through the medium of the Society, if thought worthy of its notice.

* See Vol. VII. of the *Technical Repository*, pages 245 and 282.

† From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

I possess several barrels, made in my brother's presence, by a Damascus workman; which, with specimens of the work in different branches, I shall be happy to lay before the committee of Mechanics*.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c.* T. M. Bagnold.

On the Damascus Gun-barrels.

The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, *are manufactured of iron hoops, obtained from European casks, mostly British.* The more these hoops *are corroded with rust,* they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one-third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before: and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping† is used than in the English method, *in order to render the twist finer.* The most careful workmen always make a practice of *covering the part exposed to the fire with a lute, com-*

* These are in the Society's Repository.

† Or *upsetting endways,* by striking the barrel against the side of the anvil, whilst it is of a welding heat.—Editor.

posed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised, by laying the barrel, from one to five days, either in vinegar, *or a solution of the sulphate of iron,* until the twist is raised; this process is called *the wire twist.*

To produce the *curl,* the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right, and others to the left-hand; one of each sort are then welded together, doubled up and drawn out, as before described; and, according to the skill and experience of the workman, any intricacy of twist is produced by this drawing out, doubling, and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. *A native artist never works with pit-coal, under any consideration: charcoal from light wood forms his only fuel.*

On the Damascus Sword-blades.

In making the sword-blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer*. These are drawn out to one third more than the length of the intended blade, doubled up, heated, twisted, and reforged several times; the *twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of two *broad* plates of steel, thus prepared, with a *narrow* plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge* of a considerable depth.

* *The soldering steel or iron with cast-iron and borax, and welding afterwards,* thus seems to be *an Eastern practice!* See our articles "*On soldering thin sheet-iron with cast-iron.*" Vol. IV. pages 21 and 233.—Editor.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give it strength and toughness*.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

The Hardening Composition.

The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, *heated to a moderate red-heat; and just as the red was changing to a black heat, quenched in spring-water.*

From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel; of which there are great quantities, but little or no demand for it. The *Damasque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solution.

XXXIII.—*On the superior advantages of employing a soft and gentle blast from the Bellows of Smiths' Forges in certain cases, over the sharp blast produced in the ordinary manner of employing them.* By DUNCAN CAMPBELL, *Esq.*†

MR. CAMPBELL is enabled to perform many of the most delicate and difficult operations in smithery, and in particular *to weld two pieces of tolerably hard cast steel together*, a thing held to be scarcely possible, by this improvement.

He employs a small pair of smiths' bellows, viz. only eighteen inches in breadth, and instead of overloading

* We have found one of these *celebrated blades* to be composed of plain and *hard steel* or *wootz* in the middle, to form the edge: iron at the back, and the mixture of veined steel on both sides, to give it *strength, toughness, and beauty.*—EDITOR.

† See our article on Turning-tools, page 130.

their upper board with weights, as usual, in some cases *he actually removes much of their own weight, by counter-balancing weights.*

In commencing to heat a mass of iron, Mr. Campbell indeed loads his bellows with weights, but, as the mass becomes heated, and especially when it approaches towards a welding heat, he gradually removes them; and, at length, hangs them upon a hook, attached to a line, passing over a pulley, and affixed to the hinder part of the upper board, so as to take off the greater part of its weight. He can thus keep a mass of iron in a continued heat as long as he pleases, and cause the heat to penetrate to the interior of the mass without burning away its exterior, or oxyding it, by the force of the blast, as usual. We have thus seen him bring a mass of iron, two inches square, and seven or eight inches long, to a welding heat, without the use of sand, to defend its outward parts in the fire; and to continue it in that state for a considerable length of time.

Mr. Campbell also uses a wider aperture to his bellows and tuyere than is usual; his tuyere is an inch in diameter, and widens towards the forge fire, and it thus diffuses the blast more uniformly than in common.

He assures us, and we do not doubt the fact, that he can lay two peices of cast-steel, properly shaped, under the hammer for welding, as usual, upon each other, in his forge fire; and, by regulating and tempering his blast, cause them to sweat, fuse, and finally unite together, without hammering!

Mr. Campbell so manages his bellows-handle, by a repetition of short and quick strokes, that towards the end of a heat he does not ever cause the upper hoop of the bellows to rise, and add its weight to increase the force of the blast. It is also his intention to add a gasometer to his bellows, to equalize the blast, and thus avoid those little irregularities which at present he unavoidably experiences.

We must own, that in all our experience we have never the lathe, and reversing its motion continually, as in copying screws from other screws affixed upon the sliding or pumping mandrel of the lathe, *the lathe here is a common one, and continues to revolve*, and the guide and screw-tool only need to be shifted, as above described.

XXXVI.—*On Climate, with regard to Horticulture.* *By* JOHN FREDERIC DANIELL, *Esq. F.R.S. &c.**

THE following observations were committed to paper, and submitted to the consideration of the Horticultural Society, at the particular request of their secretary. The author would scarcely have thought them novel or important enough for such a destination, but he defers to his judgment, and shall at all events have had the pleasure of complying with his wishes.

Horticulture differs from agriculture in one very material respect. The latter has for its object the fertilization of the soil by manures, and the different processes of cultivation, in the manner best adapted to the peculiarities of any given climate, it concerns itself only with the growth and nourishment of such plants as are indigenous, or, by a long course of treatment, have become inured to the vicissitudes of weather incidental to a particular latitude. The former occupies a much wider field of research; it not only seeks to be conversant with the constitution of soils, but, as it aspires to the preservation and propagation of exotic vegetation, it necessarily embraces the consideration of varieties of climate: and it labours by art to assimilate the confined space of its operations to that constitution of atmosphere which is most congenial to its charge, or to protect them at different periods of their growth from sudden changes of weather, which would be detrimental to their health. Experience has anticipated theoretical knowledge, in suggesting various artifices, by which these ends may be effected; a connected view of

* From Vol. VI. of the Transactions of the London Horticultural Society.

which has never, I believe, been attempted, but may prove to be not without interest and utility. The suggestions of experience, may, probably, enlarge the conclusions of theory; while it is not impossible that the improved state of the latter may be found to furnish some assistance to the former.

The science of horticulture, with regard to climate, will be best considered in two divisions: the first comprises the methods of mitigating the extremes, or exalting the energies, of the natural climate in the open air: the second embraces the more difficult means of composing and maintaining a confined atmosphere, whose properties may assimilate with those of the natural atmosphere in intertropical latitudes. I shall commence my observations with the former.

The basis of the atmosphere has been proved to be of the same chemical composition in all regions of the globe. All the varieties of climate will therefore be found to depend upon the modifications impressed upon it by light, heat, and moisture; and over these art has obtained, even in the open air, a greater influence than at first sight would appear to be possible. By judicious management, the climate of our gardens is rendered congenial to the luxurious productions of more favoured regions; and flowers and fruits, from the confines of the tropics, flourishing in the open air, daily prove the triumphs of knowledge and industry.

For the complete understanding of the subject in all its bearings, and to enable us to derive all the practical advantages which such an understanding would certainly afford, it would be necessary to have a full knowledge of the peculiarities of climate of every region of the earth; a knowledge which we are very far from yet possessing, but to which rapid advances are daily making. But, above all, it seems necessary that we should understand the atmospheric variations of our own situation. These, though the lathe, and reversing its motion continually, as in copying screws from other screws affixed upon the sliding or pumping mandrel of the lathe, *the lathe here is a common one, and continues to revolve*, and the guide and screw-tool only need to be shifted, as above described.

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The amount of evaporation from the soil, and of exhalation from the foliage of the vegetable kindgdom, depends upon two circumstances, the saturation of the air with moisture, and the velocity of its motion. They are in inverse proportion to the former, and in direct proportion to the latter.

When the air is dry, vapour ascends in it with great rapidity from every surface capable of affording it; and the energy of this action is greatly promoted by wind, which

* The *dew-point*, (a term which will often occur in the course of this paper), is the degree of temperature at whieh the moisture of the atmosphere would begin to precipitate, and may readily be ascertained at all seasons by means of the hygrometer. The natural scale of the hygrometer, is included between the points of perfect dryness and perfect moisture; the latter, of course, being that state of the atmosphere at which the *dew-point* coincides with the temperature of the air. The intermediate degrees may be ascertained by dividing the elasticity of vapour at the temperature of the dew-point, by the elasticity at the temperature of the air: the quotient will express the proportion of moisture actually existing, to the quantity which would be required for saturation; for, calling the term of saturation 1,000, as the elasticity of vapour, at the temperature of the air, is to the elasticity of vapour at the temperature of the dew-point, so is the term of saturation to the actual degree of moisture. The necessary tables for facilitating this calculation, and more detailed explanations than it is possible to comprise in a note, may be found in the author's *Meteorological Essays*.

removes it from the exhaling body as fast as it is formed, and prevents that accumulation which would otherwise arrest the process.

Over the state of saturation, the horticulturist has little or no control in the open air, but over its velocity he has some command. He can break the force of the blast by artificial means, such as walls, palings, hedges, or other screens; or he may find natural shelter in situations upon the acclivities of hills. Excessive exhalation is very injurious to many of the processes of vegetation, and no small proportion of what is commonly called *blight*, may be attributed to this cause. Evaporation increases in a prodigiously rapid ratio with the velocity of the wind; and any thing which retards the motion of the latter is very efficacious in diminishing the amount of the former; the same surface, which in a calm state of the air would exhale 100 parts of moisture, would yield 125 in a moderate breeze, and 150 in a high wind. The dryness of the atmosphere in spring renders the effect more injurious to the tender shoots of this season of the year, and the easterly winds, especially, are most to be opposed in their course. The moisture of the air flowing from any point between N. E. and S. E. inclusive, is to that of the air from any other quarter of the compass in the proportion of 814 to 907, upon an average of the whole year; and it is no uncommon thing in spring for the dew-point to be more than 20° below the temperature of the atmosphere in the shade, and I have even seen the difference amount to 30°. The effect of such a degree of dryness is parching in the extreme, and if accompanied with wind, is destructive to the blossoms of tender plants. The use of high walls, especially upon the northern and eastern sides of a garden, in checking this evil, cannot be doubtful; and in the case of tender fruit trees, such screens should not be too far apart.

And here theory would suggest another precaution, which, I believe, has never yet been adopted, but which would be well worthy of a trial. When trees are trained upon a wall with a southern aspect, they have the advantage of a greatly exalted temperature, but this temperature, in spring, differs from the warmth of a more advanced period of the year, or of a more southern climate, in not being accompanied by an increase of moisture. In the extremely dry state of the atmosphere to which I am now alluding, the enormous exhalation from the blossoms of tender fruit trees which must thus be induced, cannot fail of being extremely detrimental; the effect of shading the plants from the direct rays of the sun should therefore be ascertaiued. The state of the weather to which I refer often occurs in April, May, and June, but seldom lasts many hours. Great mischief, however, may arise in a very small interval of time; and the disadvantage of a partial loss of light, cannot be put in comparison with the probable effect which I have pointed out.

During the time in which I kept a register of the weather, I have seen, in the month of May, the thermometer in the sun at 101°, while the dew point was only 34°; the state of saturation of the air, upon a south wall, consequently only amounted to 120°, a state of dryness which is certainly not surpassed by an African harmattan. The shelter of a mat, on such occasions, would often prevent the sudden injury which so frequently arises at this period of the year.

Some of the present practices of gardening are founded upon experience of similar effects; and it is well known that cuttings of plants succeed best in a border with a northern aspect, protected from the wind: or, if otherwise situated, they require to be screened from the force of the noon-day sun. If these precautions be unattended to, they speedily droop and die. For the same reason, the autumn is selected for placing them in the ground, as well as for transplanting trees; the atmosphere at that season being saturated with moisture, is not found to exhaust the plant before it has become rooted in the soil.

Over the absolute state of vapour in the air we are wholly powerless, and by no system of watering can we affect the dew-point in the free atmosphere: this is determined in the upper regions. It is only, therefore, by these indirect methods, and by the selection of proper seasons, that we can preserve the more tender shoots of the vegetable kingdom from the injurious effects of excessive exhalation.

Radiation, the second cause which I have mentioned as producing sudden and injurious influence upon the tender products of the garden, is one that has been little understood, till of late years, by the natural philosopher; and even to this day has not been rendered familiar to the practical gardener; who, although he has been taught by experience to guard against some of its effects, is totally unacquainted with the theory of his practice. Dr. Wells, to whose admirable *Essay upon Dew* we are so much indebted for our present knowledge upon this important subject, thus candidly remarks upon this anticipation of science:—"I had often, in the pride of half knowledge, smiled at the means frequently employed by gardeners to protect tender plants from cold, as it appeared to me impossible that a thin mat, or any such flimsy substance, could prevent them from attaining the temperature of the atmosphere, by which alone I thought them liable to be injured. But when I had learned that bodies on the surface of the earth became, during a still and serene night, colder than the atmosphere, by radiating their heat to the heavens, I perceived immediately a just reason for the practice which I had before deemed useless."

The power of emitting heat in straight lines in every direction, independently of contact, may be regarded as a property common to all matter; but differing in degree in different kinds of matter. Co-existing with it, in the same degree, may be regarded the power of absorbing heat so emitted from other bodies. Polished metals, and the fibres of vegetables may be considered as placed at the two extremities of the scale upon which these properties in different substances may be measured. If a body be so situated that it may receive just as much radiant heat as itself projects, its temperature remains the same: if the surrounding bodies emit heat of greater intensity than the same body, its temperature rises till the quantity which it receives exactly balances its expenditure, at which point it again becomes stationary: and if the power of radiation be exerted under circumstances which prevent a return, the temperature of the body declines. Thus, if a thermometer be placed in the focus of a concave metallic mirror, and turned towards any clear portion of the sky, at any period of the day, it will fall many degrees below the temperature of another thermometer placed near it, out of the mirror; the power of radiation is exerted in both thermometers, but to the first all return of radiant heat is cut off, while the other receives as much from the surrounding bodies as itself projects. This interchange amongst bodies takes place in transparent *media* as well as in *vacuo;* but in the former case the effect is modified by the equalizing power of the medium.

(To be continued.)

XXXVII.—*On the Material employed in Tuscany for Fine Plat. By Mr.* WILLIAM SALISBURY*.

IT appears that specimens of the straw, with seeds of the plant, were, in 1819, brought to this country by Captain Roper, R. N., and were presented by him to H. R. H. the Duke of Sussex, President of the Society. Some of these seeds his Royal Highness gave to Mr. Salisbury, who sowed and obtained a crop from them in the following year. The plants being allowed to come to maturity, proved to be the *triticum turgidum,* a variety of bearded wheat, which seems to differ in no respect from the spring-wheat grown in the vale of Evesham, and in other parts of England.

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted its silver Ceres medal to Mr. Salisbury for this communication.

In the autumn of 1823, M. Fournier, of Geneva, a friend of Mr. Salisbury, being about to make a journey to Florence, was requested to make enquiries for him, respecting the culture and subsequent preparation of the bearded wheat, as far as regards its application to the purposes of platting.

M. Fournier states that the bearded wheat is cultivated largely in Tuscany, both for food as well as for platting; and that he saw the plant grown for its straw alone, in various parts of the Val d'Arno, between Pisa and Florence. The seed is thickly sown on a poor stony soil, on the bank of the river: when the crop is some inches high, it is mown, but not very close to the ground; this treatment subdues, more or less, the rankness of the plant, and the stems that shoot up are slenderer than before. If they are still too coarse, the crop is again mown, and so on to a third and even a fourth time, according to the vigour of the plant. When the stems are sufficiently fine, they are allowed to grow; after the bloom is over, but while the grain is still very milky, the plants are pulled up, and exposed to the sun on the sand of the river, care being taken to water them from time to time. When the straw is come to proper colour, a very careful selection is made of it, according to its quality, and it is divided into several sorts, according to the size of the straw. The only part used is from the base of the ear a few inches down towards the first joint. The part between the first and third joint is reserved for common plat.

Specimens of the straw, in its unprepared and prepared state, collected by M. Fournier, and given by him to Mr. Salisbury, were laid before the Committee of Manufactures.

XXXVI.—*Observations on the Culture of Silk. By the late* ARCHIBALD STEPHENSON, *Esq. of Mongreenan, in Ayrshire**.

HAVING resided for five years in the provinces of Languedoc and Quercy, in the south of France, where the utmost attention is paid to the culture of silk; I embraced that opportunity of observing with care, the manner in which this lucrative branch of manufacture and commerce was carried on: and, indeed, I was led to bestow the more attention upon this important subject, from an idea I entertained, that this valuable culture, by proper care, might certainly be introduced into Great Britain, particularly in the southern parts of this island, where there are large tracts of land, which would answer perfectly for the production of the mulberry tree, and which, from the nature of the soil, can never be employed to any great advantage in raising of corn.

To show in some measure, that this object well merits the attention of this country, it may not be improper to mention, that from a memorial in relation to the culture of silk in France, drawn up for the inspection of the French minister, and of which I was favoured with a perusal, by the author thereof: it appeared that the value of the raw silk raised in France in the year 1764, amounted to no less than thirty millions of livres; and it must naturally be supposed, that the value of it must now be encreased considerably, as the culture of silk has been extending itself rapidly towards the more northern parts of the country since that period.

Having with great pleasure observed the progress which has been made by the Society of Arts, &c., with a view to introduce this valuable culture into Britain, I must beg, as a mark of the high respect in which I hold the Society, for their unremitted attention to every object which can serve

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

to promote the prosperity of this country, to be permitted the honour of laying before them the following observations in relation to that culture, which I collected during my residence in France; and shall reckon myself particularly happy, if any of them shall be found to be of use to them, in the prosecution of the truly patriotic views of the Society.

1st. It appears proper to begin, by giving some little account of the mulberry tree, since, as the Society justly observes, this is the first object which claims our attention: because we must first of all make some provision of food for the silk-worms, before any trial at large can be carried into execution with any propriety, or indeed, with any rational hope of success.

There are two kinds of the black mulberry tree which have been cultivated in France. The first of these bears a fruit well known, and frequently presented at table, being the same which is cultivated in our gardens in the neighbourhood of London. But the leaves of this tree have been found, from experience, to be too harsh and too succulent, to prove in every respect a proper food for the silk worm; and the silk it yields turns out to be coarse, and of an inferior quality.

The second kind of the black mulberry tree carries a fruit inferior to the other in point of size, and improper for the table: but the leaf of it has been found to be superior to the first, as food for the silk worm; and it is less harsh less succulent, and yields silk of a finer quality than the one first mentioned.

This second sort of the black mulberry is, in all probability, the particular kind, which is said to be at present cultivated in the kingdom of Valencia, in Spain, for the use of their silk-worms: and, indeed, many of their old plantations in France, consist of this sort. But their new plantations consist wholly of the white mulberry tree, hereafter to be mentioned, which is the only one they now cultivate in all their nursery grounds, for the use of their silk worms; so far at least as I had occasion to see them.

There is a third sort, known by the name of the white mulberry, the leaf of which is more tender and less succulent than any of the other two, and has been found to produce silk of the finest and best quality.

Some people, I find, have been led to think, that this kind of the mulberry tree does not carry any fruit, and that it can only be propagated by layers; but in this particular the fact stands much otherways. For, though the white mulberry may not perhaps produce any fruit in a climate so far to the north as ours, which, however, I do not take it upon me to say is the case; yet the truth is, that in climates such as that in the south of France, this tree carries fruit in very great quantities, though it is of a smaller kind than either of the two already mentioned.— It is of a dusky white collour, rather inclining a little to the yellow; and contains a number of small seeds, like mustard seed; from which large nurseries of this valuable tree are now annually raised all over the southern parts of France.

For a number of years after the culture of silk was introduced into France, the people were accustomed to employ the leaves of all the different kinds of mulberry trees before mentioned, promiscuously: and some grafts of the white mulberry from Piedmont, and from Spain, which carried a larger leaf than the one they had got in France, having been obtained from these countries, these grafts were put upon French seedling stocks, which had the effect of increasing greatly the size of the leaves, and was regarded as an acquisition, as it certainly produced a larger stock of leaves as food for the worms. The consequence of which was, that this practice of grafting prevailed for a great many years all over Provence and Languedoc.

But Monsieur Marteloy, a physician at Montpellier, who had made the culture of the silk-worm his particular study for a number of years together, at last made it clearly apparent to the conviction of every body, by a regular course of attentive and well-conducted experiments that the leaf of the seedling white mulberry was the food of all others the best for this valuable insect; as the worms which were fed with this particular leaf were found to be more healthy and vigorous, and less subject to diseases of any kind than those that were fed upon any of the other kinds of leaves above mentioned; and that their silk turned out to be of the very best quality. Since that time, namely. 1765, a decided preference has been given to this particular leaf beyond all the others.

As our British gardeners are, in my opinion, more intelligent in their business than any of the French gardeners, at least whom I had occasion to meet with in France, it may, by some, perhaps be reckoned unnecessary for me to say any thing here, with respect to the culture of the mulberry tree; but when it is considered that the culture of this tree has been so anxiously attended to in France, for a long period of years past, and that I do more than justice to the French gardeners, when I say, that they succeed perfectly in this culture, it may not be deemed altogether improper for me to add here the method I observed to be used in France in cultivating the mulberry tree.

I shall therefore go on to observe, that their first object is to make choice of a spot of ground for their seed bed, of a gravelly or sandy soil, which has been in garden culture, or under tillage for some time, and which they know to be in good heart. When this ground is thoroughly dressed, they make drills at the distance of two feet from each other, in which they sow the seeds, in the same manner as they usually do lettuce for salads. They then cover the seeds lightly with some of the finest earth, after putting it through a sieve; and if the weather happens to be dry, they water it slightly once or twice a week, as they judge to be necessary. These seeds they sow as above, at any time from the end of April to the end of May, and even during the first week in June; and I observed that some gardeners, the better to ensure success, were in the practice of sowing the seeds at three different times during the same season: to wit, the first sowing in the last week of April; the second about the middle of May; and the third in the beginning of June.

When the plants are fairly above ground, they take particular care to keep them clear from weeds, and from time to time, to point with a spade or a hoe the ground in the intervals betwixt the different drills.

After remaining for two years in the seed bed, they take up the plants: such of them as are of the size of a writing quill, they plant out in the nursery grounds; each plant at two feet distance from each other in the row, and the rows at three feet distance from each other, that there may be room for cleaning and dressing the ground betwixt the plants. At transplanting, they cut off nearly the half the root, and also cut off the tops at about six or seven inches above the ground. All the other plants which are too small for the nursery, they plant out thick by themselves, to remain for another year, or two, if necessary: after which they plant them out in the nursery grounds as as above. The most proper time for transplanting the mulberry tree is just after the fall of the leaf in autumn.

When the plants in the nursery are sprung, they take care to strip off the side buds, and leave none but such as are necessary to form the head of the tree.

If the plants in the nursery do not shoot well the first year, in the month of March following they cut them over about seven inches from the ground, which makes them come on briskly the year following.

When the plants are grown to the size of one inch diameter, they plant them out in the fields where they are to remain, making the pits where they plant them of the size of six feet square, and dressing the ground for twenty inches, or two feet deep.

During the first year of planting out, they leave the whole buds which the trees have pushed out on the top until the following spring, when they take care to leave none but three or four branches to form the head of the tree; and as the buds come out, they take off all those which appear upon the body of the tree, from the bottom all the way up to those which are left to form the head of the tree; and for several years after, at the seasons above mentioned, they take care to open the heads of the trees, when too thick of wood, and particularly to cut off any branch which seems to take the lead from the rest, and to engross more of the sap than what falls to its share, that the different branches may increase equally as much as possible.

After the trees are planted out, and likewise while the plants are in the nursery grounds, they take care to dress the ground about the trees regularly three or four times a year, which greatly assists the trees to get on.

Here it is proper to mention, that it is the practice in France to plant out some of their young plants from the nursery by way of espalier, in some sheltered situation, in a garden, for example, where the soil is not over rich; and if it can be had, where the soil has a great proportion of gravel or sand; the intention of which is, to procure early leaves for the worms in their infant state; as these leaves generally come out more early upon dwarfish plants in a sheltered situation, than upon the trees planted out in a more open exposure; and upon this occasion they have also recourse for tender leaves to their young plants in the seed bed and nursery grounds.

Any quantity of the seed of the white mulberry can be obtained either from Montpellier or Marseilles, where it is regularly to be found for sale in the seed shops. And if you do not choose to trust entirely to the seed shops, a friend at either of those places may be applied to, who will take care to procure for you the freshest and best seed. It may also be obtained by the same means from Spain; the seed from which country is even preferable to that from

France, as the Spanish tree carries a larger leaf than that of France, and has the leaf equally tender and good as the other, when used from the seedling trees.

From the experiments carried on by Monsieur Marteloy, that gentleman made it fully appear that the leaves of the trees which grew in a rich soil were by no means proper food for the silk worm, as they were too luxuriant and full of juice for them; and that the leaves of those trees which were raised in a gravelly or sandy soil, where no manure was employed, were greatly to be preferred.

From these experiments also, one of the reasons, and apparently the principal one, may now be pretty clearly pointed out, which rendered abortive the trials made in England, during the reigns of James I. and Charles II. for introducing the culture of silk into Great Britain: though that reason was altogether unknown in England, at the times these different trials were made. It appears to have been only this, that they had no other food to give to their worms but the leaves of the black mulberry, carrying the large fruit usually presented at our tables, which is now altogether rejected in France as an improper food for the worms; and which was rendered infinitely more destructive for these insects by the trees which produced them having been all of them reared in the richest ground in England, namely, in the garden grounds about London, which we know are in a manner yearly loaded with dung.

The mulberry trees ought not to be pruned the first year after planting out, for fear of making them bleed too much: but in the second spring it is reckoned advisable to dress their heads, and to continue to repeat that dressing yearly, during the next ten or twelve years; taking care to make them hollow in the middle, so as to give a free passage for the air, and to render it easy to gather the leaves. After the first twelve years are over, it will be sufficient if a dressing of the same kind is regularly given to them once every three years. But as some of the branches may probably be broken annually, in gathering the leaves, care must be taken to prune all such branches as may happen to be thus broken, to prevent the trees from suffering materially by such accidents.

In planting out the mulberry tree in the field where it is to remain, care must be taken to cover the roots properly, so that the earth may not lie hollow upon them, which would injure the plant. They should also take care to prop the different trees with stakes, to prevent them from wind-waving; placing straw next the body of the tree, to prevent the bark from being hurt; and it will be proper also to surround them with briars or brambles to preserve them from all injury from cattle.

Here it is proper to remark, that the second crop of leaves which come out upon the mulberry trees, after having been stripped of their first leaves for the use of the silk-worm, are not allowed to fall of themselves in autumn. They are gathered for the second time with care, a little before the time they would fall naturally, and are given for food to their sheep, and eaten by them with greediness, and by that means turn out to good account to the farmer. Before the culture of silk was introduced into that part of Languedoc which is near to the mountains of Cevennes, the peasantry over all that neighbourhood were miserably poor, as their soil, which is mostly gravel and sand, was incapable of carrying crops of any kind of grain what ever. But as it was found, upon trial, to answer remarkably well for the mulberry tree, the people entered with great alacrity into the culture of silk; and they have succeeded so well in that lucrative branch, that from having been amongst the poorest, they are now more at their ease than most of the peasantry of that kingdom.

When I happened to be at Gange, which is within the district above mentioned, and which is remarkable for the manufacture of silk stockings, I was carried to see some mulberry trees, belonging to a farmer in the neighbourhood of the village, which were the first that had been introduced into that part of the country. The trees were remarkably large and fine, and little inferior in point of size to our elm trees of the middling sort. The people who obligingly attended me to show me these favourite trees, assured me that a good many of the largest of them brought a return to the farmer's family of a Louis d'or each of them yearly.

As an encouragement to the small heritors and farmers to plant mulberry trees upon their grounds; the French government are at an annual expense in keeping up large nurseries of these trees in many different parts of the country, from whence the small heritors and farmers are liberally supplied gratis with whatever numbers of these trees they desire to plant out upon their grounds; and proper directions are ordered to be given along with the trees, by the gardeners who are charged with the care of these public nurseries, that the people to whom the trees are thus given may know how to treat them properly. This beneficent public measure is attended with great advantage to the country, as the poorer people are by this means saved from the trouble and expense of rearing the trees, until they come to be of a proper size for planting out in the fields, where they are intended to remain.

From the extension of the culture of silk over all the southern parts of France, there is a great increasing demand yearly for the mulberry leaves; so that they are now become as much an article of commerce as any other vegetable production; the peasants with eagerness buying them up annually with ready money at the proper season for the use of the silk-worms.

This last circumstance has given great encouragement to gentlemen of property to raise extensive plantations of mulberry trees upon their estates; as they bring in a certain and steady revenue, with little trouble or expense to the proprietor, after the trees have once passed the risk of being hurt by cattle. And this improvement is of the more consequence, because the grounds that are found to be the fittest for production of the mulberry-trees, which afford the best food for the silk worms, being gravel or sand, cannot be employed with any advantage in the raising of corn, more especially where the manures lie at a distance from them.

Grounds of the above description had formerly been in use to be planted with vines; but the returns from these were far from being equal to what is obtained from grounds of the same quality when planted with mulberry trees.—As an instance of this, I shall take the liberty of mentioning the following particulars, which I had from a gentleman, on whose veracity I am certain I could fully depend.

He told me there was a gentleman, a surgeon of Nismes, in Languedoc, who had a tract of very poor ground in that neighbourhood left to him by his father; which, when it came into his possession, yielded him a rent of three hundred livres, which amounts in our money to twelve guineas and a half. As this gentleman observed that the culture of silk was extending itself rapidly over that part of the country, he planted the whole of his little property with white mulberry trees, the leaves of which, as his plantations advanced, he found he could regularly sell annually for ready money to the people in the town of Nismes and in the neighbourhood, who employed themselves in the culture of silk; and my friend informed me, that these very grounds, after having been only sixteen years planted, gave a return to the proprietor of twelve hundred livres yearly; amounting to fifty guineas of our money. This improvement having been carried on under the eye of the neighbouring heritors, several of them pursued the same plan with equal success; and some of them who had grounds of the same quality which had been long planted with vines, actually grubbed up their vine-yards, and planted their grounds with the white mulberry; and here let me add, that the mulberry tree is long lived, there being many instances where they have stood perfectly good for above one hundred years.

When the young mulberry trees are in the seed bed, and even when afterwards planted out in nursery grounds, and likewise for several years after they are planted out in the fields to remain, you must be careful every night, in the spring and summer seasons, to examine with care all round your plants for a little snail without a shell, which is very fond of the bark of these trees when young, and preys upon them prodigiously. These snails will cut over your young plants in the seed beds and nursery-grounds; and will even continue to prey upon the trees till they are pretty old; and though they do not absolutely kill the trees when planted out, yet they hurt them greatly, and retard their growth. These snails, therefore, must be gathered up every night as above mentioned, a little after sun-set, which is better than in the morning, because the mischief they occasion is generally done in the night; and they must be burnt, or otherwise effectually destroyed; for if you do not kill them they will find their way again to the trees.

The winter of 1765 I passed at Montauban in Quercy, when the frost was so extremely severe that it not only destroyed the greatest part of the leguminous crops, and almost the whole produce of the kitchen garden, but also many of their vines, fig, and olive trees, and a great part of the orange trees in their green houses; yet that frost, with all its severity, did not occasion the smallest injury to the mulberry trees, nor to the eggs of the silk-worms. This frost continued for two months together, and was within two degrees and a half of the great frost in 1709. But what is still more remarkable, I was assured from the most respectable authority, that even the frost of 1709 did not cause the smallest injury to the mulberry trees, though it destroyed many of their vines, and almost their whole fig and olive trees all over Provence and Languedoc. From which two instances I think it may be fairly inferred, that we have no reason to dread any danger to the mulberry trees from the severity of our British climate.

I shall now proceed to give an account of the manner used in France for disengaging the seeds from the fruit of the mulberry, which requires a considerable degree of labour as well as attention.

Having gathered the quantity of fruit you propose to set apart for seed, which must be thoroughly ripe before it is pulled, you put the fruit into a large tub or vessel, where you cause a person to tramp and press it with his bare feet, in order to bruise the whole of it thoroughly, and by that means disengage the seed from the little pods or cells in which it is contained.

You must at the same time have in readiness another tub, which must be pretty deep, into which you introduce a piece of flat wood, which must be made to rest upon the sides of the tub, at the distance of six, eight, or more inches from the bottom of the tub, as you shall judge to be necessary for your quantity of fruit. This cross piece of wood is calculated to support a round cane sieve, which is to rest upon it. This sieve, must be very fine, that is, the holes must be very small and close set together, that as little of the pulp of the fruit as possible may go through the holes along with the seed.

Things being thus prepared, and the tub filled so far with water that it may rise more than half way up the brim of the sieve, when placed upon the piece of wood, you then put a handful or two of the bruised fruit into the sieve, which you rub hard with your hands upon the bottom of the sieve, in order to make the seed pass through the holes, and every now and then you lift up the seive with both hands, and shake it to make the water pass through it, which carries the seed along with it. Besides rubbing the fruit with your hand upon the bottom of the sieve as above, you also take it and rub it heartily betwixt the two palms of your hands, rubbing the one hard against the other; as it takes a great deal of work and pains to get the seed disengaged out of their little cells, which must be done effectually before the seeds will pass through the holes of the sieve.

This work must be repeated till you observe that the whole of the seed has passed through the holes of the sieve; after which you throw aside the pulp, and must proceed in the same manner with the rest of the fruit, till you have finished the whole.

You then take the sieve and piece of wood out of the tub, and pour off all the water, when you will find the seed at the bottom; but along with it a great quantity of the pulp, which has been forced through the holes of the sieve, in rubbing the fruit hard upon the bottom of it with your hand, as above mentioned.

I should have noticed, that all the seeds which swim upon the surface of the water, are light and good for nothing, and must, therefore, be thrown aside.

You then put the pulp and seed, which you find mixed together at the bottom of the tub, into another vessel, and fill the tub with water as at first, having put the piece of wood and the sieve in their proper places as before, after which you pass the pulp and seed, by degrees, through the sieve, by rubbing it with your hand upon the bottom as before, and lifting up the sieve from time to time, with both hands, and shaking it, as already mentioned. In passing it this second time you will disengage a great quantity of the pulp, which you throw aside from time to time, as soon as you observe that none of the seed remains amongst it.

You then pour off the water as before; and if you find that there is still some of the pulp remaining with the seed, you must pass it a third time through the sieve, which will effectually clean it, if your sieve is fine enough.

If your sieve is too coarse, that is, if the holes are too large, it will occasion you a great deal more work, as you will be obliged to pass it oftener through the sieve, since that operation must be repeated till the seed is perfectly clean; after which you must spread the seed upon a clean cloth, and expose it to the sun, till it is thoroughly dry. Three days, or even four days of a full sun are necessary to dry and harden the seed properly for keeping.

Upon this part of our subject it seems proper to add, that in a cool moist country, such as about Paris or London, it is reckoned the mulberry tree carries a double, nay, nearly a triple quantity of leaves to what it can do in the hotter or drier climates, such as that of the south of France, which is judged to be owing to the moisture of the climate, and the superior richness of the soil. In a cold moist climate a person is not able, even with the utmost care, to produce above the half of the cocoons from the same quantity of eggs which can be done in a warmer and drier climate. But as in the colder climate the mulberry tree carries nearly three times the quantity of leaves, which it can do in the other; from thence it arises, that the colder climates, such as those before mentioned, are able, upon the whole, to raise at least as much silk, from the same quantity of eggs, as the warmer countries; because the quantity of food is the great article, as the grain or eggs of the silk-worm can easily be multiplied to as great a quantity as you please.

II. Having thus gone through the articles of greatest importance, so far as they occurred to me, in relation to the first and leading branch of our subject; the next which naturally falls to be considered, is the method observed in France in hatching the worms. But before proceeding to this article, it may not be improper to premise the following particulars, as they seem justly to demand a very particular attention.

Here then I must observe, thar the greatest care ought to be taken to procure healthy good seed or eggs, because it has been ascertained from repeated experience, that the eggs from those houses where the worms were infected with bad air, carries along with it to the worms produced therefrom, the same distempers to which the worms of the preceeding year were subject.

The eggs, in order to be properly preserved, should be kept in some dry place, with a free air not too hot; and that you should avoid keeping them in any vault or cellar under ground; because any kind of damp is found to be destructive to them.

The eggs of the silk-worm have been found to degenerate in the space of five years; hence a change from time to time is judged to be necessary, taking care to have the eggs brought from a warmer to a colder climate. This, however, must be done by degrees, and not carried at once from one extreme to another. For example, eggs brought from the Levant, the isle of Cyprus, or from other countries of the same latitude, ought not to be brought at once into such a cold climate as that of Flanders, or the north of France; but should be first brought into such a climate as that of Provence or Languedoc, from whence, after having remained there for two years, it can be brought with safety into the colder countries.

The first year that the eggs are brought from a warm to a cold climate, you must not expect great success from them; on the contrary, you will find, though the utmost care and attention are given to them, that the greatest part of the worms will die. But still you will be able to save enough to stock yourself sufficiently with eggs, which every succeeding year will be found to answer better as the worms become naturalized to the climate, which can only be brought about gradually; and indeed more time will be requisite for this purpose in Britain than in France, as the climate upon the continent is more fixed and steady than with us in England.

In transporting the eggs from one country to another, especially when this is done by sea, you must order them to be put into a bottle, which ought not to be filled more than half full, that the eggs may not lie too close together, which might run the risk of heating them, and causing them to hatch. The bottle being but half full, leaves sufficient room to the eggs to be tossed upside down, by the motion of the vessel, which keeps them cool and fresh, and hinders them from heating. After putting the eggs into the bottle, let it be carefully corked; a cover of leather put over the cork; and let that be sealed, to prevent any danger of changing the eggs. When corked and sealed as above, put the bottle into a double case, or box of wood; not only to preserve the eggs from all damp from the sea, or otherways, but also to protect them from too much heat, which would cause them to hatch. If the bottle is too full, the eggs will lie too close upon one another, and will in that case heat of themselves, and hatch, and consequently in both cases must be lost.

The eggs that are duly impregnated by the male butterfly are of a grey cindery colour, which colour they preserve till they are properly prepared for hatching, as after-mentioned. The eggs which are not duly impregnated, are readily to be distinguished from this circumstance, namely, that after having been kept for some time, they always continue to be of a yellow colour; and I need scarce add, that all such eggs are good for nothing, and ought, therefore, to be thrown away. There is no distinguishing between good and bad eggs, but by the change of colour, after being kept for some time, as above-mentioned.

One ounce of eggs will produce 40,000 worms; and so in proportion, for a larger, or smaller quantity.

These things being premised, I shall now proceed to describe the method I observed to be used in France for hatching the worms. In order to avoid the loss which must necessarily follow, if the mulberry leaves should happen to be destroyed by frost, after you have begun to prepare your eggs, they reckon it advisable to divide them, and prepare them for hatching at two different times, at the distance of ten or twelve days, the one after the other.

The advancement of the season determines the time of preparing your eggs for hatching, as you proceed to that as soon as you observe that there is a prospect of having a sufficient quantity of food for your worms, by the advancement of the leaves of the mulberry. But in order to be properly prepared for this work, you must begin a month before the usual time of hatching; first to put your eggs in little divisions, from half an ounce to an ounce, which you must place upon a piece of clean white paper, upon plates, for example; and put those plates containing the eggs in a place a little warmer than where you had kept them during the winter: for example, if you have an alcove bed, place them upon the shelf within the alcove. Let them remain in that situation for the first five or six days, after which you must prepare some little chip boxes, perfectly clean and neat, seven inches long, four inches broad, and four inches high, and cover them on the inside with clean white paper, into which put the different divisions of your eggs, having a small box for each division, and place these boxes in a basket, upon a stool or chair, at the foot of your bed; making one of the mattresses of your bed go underneath the basket; and cover the basket on the top, first with some cover of woollen cloth, which pin close over it, and above that place a bed cover above all, so as to keep in the heat communicated by the mattress to the eggs; in which situation let them remain for six days longer; after which increase the heat to 14 degrees of Reaumur's thermometer*, preserving that heat equal, night and day, by means of a little fire in some corner of the room at a distance from the bed.

In the morning when you get up, put a heater of one kind or other; for example, a tin bottle with hot water, or a foot stove, into your bed betwixt the sheets, and proportion that heat so as to equal the heat you give to the bed, when you lie in it yourself; keeping up the same heat as nearly as you can, until you go to bed again yourself in the evening.

(To be continued.)

* Or about 59 degrees of Fahrenheit.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since Feb. 4, 1826.

To Robert Rigg, of Bowstead Hill, in the parish of Burgh-by-Lands, in the county of Cumberland, gentleman; for a new Condensing Apparatus, to be used with or applied to the apparatus now in use for making vinegar. Dated Feb. 4, 1826.—To be specified in six months.

To Josias Christopher Gamble, of Liffeybank, in the county of Dublin, chemist; for certain Apparatus for the Concentration and Crystallization of Aluminous and other Saline and Crystallizable Solutions, part of which apparatus may be applied to the general purposes of evaporation, distillation, inspissation, and desiccation; and especially to the generation of steam. Dated Feb. 7, 1826.—In four months.

To William Mayhew, of Union-street, Southwark, in the county of Surrey; and William White, of Cheapside, in the city of London, hat-manufacturers; for an improvement in the manufacture of Hats. Dated Feb. 7, 1826.—In six months.

To Hugh Evans, harbour-master of the port of Holyhead, in the island and county of Anglesea, North Wales; for a certain method or methods of rendering Ships and other Vessels, whether sailing or propelled by steam, more safe, in cases of danger by leakage, bilging, or letting in water, than as at present constructed. Dated Feb. 7, 1826.—In two months.

To William Chapman, of the town and county of Newcastle-upon-Tyne, civil engineer; for certain improved Machinery for loading or unloading Ships, Vessels, or Craft. Dated Feb. 7, 1826.—In two months.

To Benjamin Cook, of Birmingham, brass-founder; for certain improvements in making files, of various descriptions. Dated Feb. 7, 1826.—In six months.

To William Warren, of Crown-street, Finsbury-square, gentleman; who, in consequence of a communication made to him by a certain foreigner resident abroad, is in possession of certain improvements in the process of extracting from the Peruvian Bark, medicinal substances, or properties, known by the names of Quinine and Cinchonine; and preparing the various Salts, for which these substances may serve as a basis. Dated Feb. 11, 1826.—In six months.

To John Lane Higgins, of No. 370, Oxford-street, in the county of Middlesex, esquire; for certain improvements in the construction of the Masts, Yards, Sails, and Rigging of Ships and smaller vessels, and in the Tackle used for working or navigating the same. Dated Feb. 11, 1826.—In six months.

To Benjamin Newmarch, of Cheltenham, in the county of Gloucester, gentleman; and Charles Bonnor, of the city of Gloucester, brazier; for a mechanical invention, to be applied for the purpose of suspending and securing Windows, Gates, Doors, Shutters, Blinds, and other apparatus. Dated Feb. 18, 1826.—In six months.

To Thomas Walter, of Luton, in the county of Bedford, straw-hat manufacturer; for certain improvements in the manufacture of Straw Plat, for the purposes of making Bonnets, Hats, and other articles. Dated Feb. 18, 1826.—In six months.

To Charles Whitlaw, of No. 18, Bayswater-terrace, Paddington, in the county of Middlesex, medical botanist; for an improvement or improvements in administering medicines, by the agency of steam or vapour. Dated Feb. 18, 1826.—In six months.

To Arnold Buffum, late of Massachusetts, in the United States of America, but now residing in Bridge-street, in the city of London, (being one of the people called Quakers,) hat-manufacturer; who, in consequence of a communication made to him by certain foreigners residing abroad, and discoveries made by himself, is in possession of certain improvements in the process of making or manufacturing and dying Hats. Dated Feb. 18, 1826.—In six months.

THE

TECHNICAL REPOSITORY.

XXXVII.—*On improved Melting Pots, for Cast-Iron and Brass. By Mr.* L. ANSTEY, *Cast-Iron Founder; with the manner of using them, and a description of his Wind-Furnace**.

WITH FIGURES.

SIR, *27, Drummond-crescent, 17th March,* 1825.

I HEREWITH send a melting-pot of my manufacture, which, from several years' experience in the melting of cast-iron, I find to answer the purpose better than any which I have been enabled to procure. They are composed of two parts Stourbridge clay, and one part of the hardest coke, well ground and tempered together. Any further explanation I should be happy to give, if required.

I am, sir, &c. &c. &c.

A. AIKIN, *Esq. Secretary, &c. &c.* L. ANSTEY.

The following particulars were stated by the Candidate to the Committee.

The composition employed by him is the following:— Take two parts of fine ground raw Stourbridge clay, and one part of the hardest *gas* coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well (if the coke is ground fine the pots are very apt to crack). The pot is moulded by hand on a

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society presented its Silver Vulcan Medal, and the sum of Twenty Guineas, to Mr. Anstey, for his communication.

wooden block, as shown plate VII. fig. 1, in which *a* is the bench; *b b* two uprights, supporting a cross board *c*, in which is a hole for the reception of the stem of the core; *d* the core, with its stem *e*, which passes loosely through the cross board *c*, and ends in a pin that turns in a hole in a metal plate, fixed to the bench; *f* is a gauge to regulate the thickness of the melting-pot, as shown by the dotted lines; *g* is a cap of linen, or cotton, placed wet on the core before the clay is put on; its use is to prevent the pot from sticking partially to the core while it is taking off; the inside of the pot is then to be made smooth, its mouth to be finished, and a lip for pouring the melted metal out to be formed: *h* is a wooden bat to assist in moulding the pot; when moulded they are carefully dried at a gentle heat.

The smaller pots hold about twenty pounds of cast-iron, and can be afforded for ten pence a-piece; the larger ones hold forty pounds, and may be afforded for fourteen pence.

A pot, dried as above, when wanted for use, is first warmed by the fire-side, and is then laid in the furnace with the mouth downwards (the red cokes being previously covered with cold ones, in order to damp the fire); more coke is then thrown in, till the pot is covered, and it is then brought gradually up to a red heat. The pot is then turned, and fixed in its proper position in the furnace, without being allowed to cool, and is then charged with cold iron, so that the metal, when melted, shall have its surface a little below the mouth of the pot. The iron is melted in about an hour and a half, and no flux or addition of any kind is used. A pot will last for fourteen or even eighteen successive fusions, provided it is not allowed in the intervals to cool; but if it cools it probably cracks. These pots will bear a higher heat than others without softening, and will consequently deliver the iron in a more fluid state than the best Birmingham pots will.

The cavity of the furnace employed by the candidate is eleven inches square in superficial area, and consists in depth of eleven rows of bricks, made of Stourbridge clay; the wind hole is four inches square, and is placed three inches below the top; the bars are either of wrought or cast iron, supported on wrought iron bearers. The ash-hole is ten courses of bricks below the bars, and the chimney is rather a high one. The sides of the furnace wear away by the heat, so that in the first week the cavity becomes two inches wider than at first. It is then brought up to its original width, by a lining of glass-cutters' mud, which consists of fine sand mixed with particles of glass; and this is renewed twice a week. The cavity of the furnace being only eleven inches across, and seven inches of that being occupied by the melting pot, it is of course necessary that the coke used as fuel should be broken into small pieces, not larger than a walnut.

At a subsequent meeting of the committee, D. Campbell, Esq., who had been requested to make some experiments on Mr. Anstey's pots, reported that he had melted a charge of iron in one of the smaller pots, placed in a powerful wind furnace; the pot remained sound.

Into a second pot was put a Wedgewood crucible, inclosing a blacklead one, and that a Cornish one; a cover was luted on, and the pot thus charged was kept for three hours in the same wind-furnace, and was brought unopened to the committee. On examination, Anstey's pot appeared to be quite entire; its shape had not altered, nor was there any change of texture, indicating an approach to fusion; it resisted several blows of a hammer before it broke. Of the crucibles inclosed in the pot, Wedgewood's had cracked to pieces, and the texture had softened considerably, and had undergone a change of shape; the Cornish one was unaltered in shape, and nearly so in texture, having only become somewhat more compact.

A third pot had been exposed for an hour to a very high heat in the same furnace, being placed on a brick of Stourbridge clay; several small crucibles had been put into it, and a cover had been luted on. On examination, the pot had undergone no change, except that the slag of the coke, which was used as fuel, had glazed it over: beneath the glaze there were no signs of fusion, nor even any change of texture. The brick support was in the state of porcelain jasper; the cover had begun to sink in: the Cornish crucible which was inclosed showed a beginning of fusion; the Chelsea crucible was bubbly, and half melted.

An empty five-inch real Hessian crucible had been heated in the same furnace as strongly as possible: it had not sunk down at all; on being broken the texture appeared porcellanous, with interspersed air bubbles, showing a beginning of fusion.

A white Birmingham pot was first annealed, and then heated (empty) in the same furnace. On examination by the committee, it was found to be cracked across the bottom, and its texture had become that of porous porcelain jasper.

Another white Birmingham pot was treated in the same manner as the former, and on examination presented several small cracks, and a porcellanous texture, but less porous than the preceding.

One of Anstey's large pots, in which five charges of iron had been melted, was shown to the committee: the form was unaltered; it withstood several blows of a hammer before it broke; the texture was granular, without any commencement of porcellanous.

Additional Observations. By the EDITOR.

When it is stated in the above account, that Mr. Anstey's chimney "is *rather a high one*," it must not be understood as being a *very lofty* one: indeed it was not higher than the ordinary chimney of a house of three stories;

THE

TECHNICAL REPOSITORY.

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WITH FIGURES.

SIR, *27, Drummond-crescent, 17th March*, 1825.

I herewith send a melting-pot of my manufacture, which, from several years' experience in the melting of cast-iron, I find to answer the purpose better than any which I have been enabled to procure. They are composed of two parts Stourbridge clay, and one part of the hardest coke, well ground and tempered together. Any further explanation I should be happy to give, if required.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* L. Anstey.

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indeed, when we consider their *perfect soundness*, arising from *casting them*, over the casualties of forging and *welding wrought-iron*, we conceive that, for many purposes, these decarbonated cast-iron articles are even preferable to those made of wrought-iron.

XXXVIII.—*On an improved Plane, for Smoothing the Surfaces of hard or coarse-grained Woods. Invented by Mr.* C. W. WILLIAMSON *.

WITH FIGURES.

SIR, 11, *New-street, Elizabeth-place, Kennington-cross.*

FEELING sensible that the Society of Arts has ever been liberal in investigating and rewarding those inventions that promote improvement in the arts, which are communicated to the public through its medium, I beg leave to offer my humble effort to its consideration.

It consists of an improved plane, for the use of cabinet makers, and others who require planes to cut either hard or coarse grained woods, and differs materially from those in common use.

My improvements consist in making the plane-iron of the finest cast-steel, and also in making it with two bevels: that is, bevelling it on both sides, by which means one iron becomes superior in its operation to the double iron that is adopted in the best planes.

To obtain this effect, I have made it sufficiently strong to resist the wedge, and to prevent its breaking by any inequality that might be in the wood or steel. The edge, by means of the two bevels, becomes much stronger, will continue its keenness much longer, and will cut much smoother than any plane with which I am acquainted.

It appears to me that planes had originally but one iron, bevelled on one side; such are yet in use, but are very

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted the sum of ten guineas to Mr. Williamson for this invention.

imperfect tools; that they were materially improved by the addition of a top iron, which, acting as an upper bevel, is the cause of the double-iron plane cutting better than the single-iron plane; but, even then, the working iron, if I might so term the lower iron, has but one bevel, which causes it to be far from a perfect tool to cut hard or coarse wood.

It appears to have been a desideratum for some years to employ cast-steel for plane-irons, on account of the fine and durable edge that it admits, superior to any other steel: for this purpose a plan was adopted for soldering cast-steel to cast-iron; but experience proved to the users of planes that, however good the plan might appear in theory, it did not answer in practice; for it was no uncommon occurrence in using such, for the steel to be forced from the iron to which it had been soldered; and when this did not occur, yet if the tempering was imperfect it could not be corrected in common practice by any ordinary workman, and I believe they are now nearly out of use. Another plan was to make plane-irons wholly of cast-steel, but these were only with one bevel, and the inequality of the surface as well as the brittleness of the steel, caused these cast-steel irons to break in a short time, when used for common work, as they could not be made thicker than the welded one, on account of the top iron; thus this plan also failed.

The superiority of two bevels is generally acknowledged in the use of turning tools, of axes, &c. but the principle has never, as far as I know, been adopted in plane-irons prior to my application of it.

Thus it appears that the advantages gained by a cast-steel single-iron, made sufficiently thick to be bevelled on both sides, are a *finer and more durable edge than can be obtained by any other steel;* little risk of the iron breaking, on account of its additional thickness; the plane not choaking; there being no top iron, and therefore no loss of time in fitting it; and its producing a smoother surface than any plane now in use,

I am, sir, &c. &c. &c.

A. AIKIN, *Esq. Secretary, &c. &c.* C. WILKS WILLIAMSON.

Mr. Williamson is in the employ of Messrs. Whiting and Branston; the latter of which gentlemen attended the committee, and stated that he has seen the candidate's plane in use *for smoothing box wood to be engraved upon*; that it cuts very smoothly and evenly, more so than other planes; and that the surface formed by it scarcely requires to be finished by the subsequent application of the scraper.

Reference to the Engraving.

Plate VII. fig. 2, is a longitudinal vertical section of the plane; *a a* the body, *b* the wedge, *c* the plane-iron. Fig. 3 shows the bevelled part of the iron *c*, and the end of the wedge *b*, full sized; and fig. 4, the iron *c c*, shown separately.

XXXIX.—*On an improved Folding Chair, invented by Mr. J. P.* HUBBARD, *of Leadenhall-street, London**.

WITH FIGURES.

IN camp, on board ship, and in other situations in which stowage room is very limited, demands are continually making on the ingenuity of the cabinet-maker, to compress into as small a space as possible all articles of domestic furniture when not actually in use. The common camp-stool, either with or without a back, thus forms the substitute for a chair; but the webbing does not make a very firm or convenient seat, and this circumstance induced Mr. Hubbard (who is not a cabinet-maker) to add

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society awarded its silver Vulcan Medal to Mr. Hubbard, for this invention.

and the upper part of it, for seven or eight feet, was formed of a thick sheet-iron cylindrical pipe, rivetted together.

The internal lining of Stourbridge bricks in his furnace was made to be renewable from time to time, as it became burnt through in use; and with this view it was not united with the external walls of the furnace, but laid in, without any Stourbridge clay or mortar being interposed between the said lining and the furnace walls.

His furnace was, at first, built on the side of his workshop, adjoining to an old rivulet: and in consequence of the *damp air* arising therefrom, he was not able to bring his heats to a sufficient height. He was therefore under the necessity of removing it to the opposite side of the workshop, where, the air being drier, he could obtain the desired result. This is a curious fact, and proves, that although for *moderate heats* a *damp air* is sufficient, and indeed is generally preferred, yet for the *intense heat* required to bring *cast-iron to a proper degree of fluidity* a dry air is requisite.

Mr. Anstey found his melting pots to wear away around their mouths, owing to the oxide of iron falling upon them from the broken pigs of cast-iron with which they were charged, and fluxing them. Had it not been for this misfortune, they would have borne a much greater number of fusions to have been made in them.

Mr. Anstey uses the *gas*-coke as fuel in his furnace, as well as for mixing with the Stourbridge clay, to form his melting pots.

He is in the practice of casting many small articles in cast-iron, and afterwards annealing or decarbonating them, by cementing them at a high red heat for a considerable length of time, say a fortnight or more, surrounded by a mixture of powdered hæmatite, and other ingredients, by which they are rendered tough and malleable, or brought to a state nearly resembling wrought-iron, and at a rate much less than they could be afforded for by forging them; and, embanked lands on these rivers being on a lower level than spring tides, are capable of being warped, which consists in surrounding the land intended to be so treated with a substantial bank, and then letting in the tide water, and allowing it to remain on the land till it has deposited nearly the whole of its mud. Thus the old soil is benefitted by the addition of new, or an entirely fresh soil is laid on the surface of the old, according to the thickness of the deposit, or the length of time that the warping is persevered in.

The usual mode of warping is to dig a main canal, or trunk, having a sluice towards the river, and to divide the lands on each side of the drain, by means of banks, into compartments of from ten to twenty acres each, and to make an entrance sluice to each compartment, together with one or more return sluices called *cloughs*. During the spring tides, in the months of August, September, and October, the sluice of the main trunk being opened, the tide water enters it, and is distributed by the lateral entrance sluices to as many of the compartments as may be convenient. When the tide is at its height, each of these entrance sluices is closed; and, as it ebbs, the hydrostatic pressure of the water in the compartments forces outwards the swinging door of the clough, and thus allows the water to escape into the main trunk, and thence into the river; having deposited nearly the whole of its mud on the surface of the inclosure in which it was penned up. The size of the cloughs should be so adjusted as to discharge the whole of the water before the rise of the next tide, otherwise only every other tide can be admitted. By this operation a deposit of silt, of the thickness of from twelve to sixteen inches, may be obtained in one season.

Mr. Creyke having ascertained that a tract of about 1600 acres of peat moss, in the neighbourhood of Rawcliffe, which produced absolutely no rent; was at a sufficiently low level to be warped, resolved to subject the whole to this mode of rendering it productive; the way in which this was effected is detailed in the following extracts from that gentleman's letters, addressed to the secretary of the Society.

Rawcliffe House, near Thorne, Yorkshire,
SIR, *Nov. 18, 1824.*

In the neighbourhood of Rawcliffe House, where I reside, are many thousand acres of peat moss and waste land, which yield scarcely any annual rent, and which I thought (from experience that I had got in improving a considerable quantity of my own land near home) might be improved very much by being warped. I accordingly undertook to warp from the river Ouse 1600 acres; and in August, 1821, a sluice, with two openings of sixteen feet each, and nineteen feet high from the sole to the crown of the arch, with substantial folding doors, was built and opened; and at the same time a main drain was cut, extending from it two miles and a half, up to the waste land and peat moss: its dimensions are thirty feet wide at the bottom, and ninety feet wide at the surface of the land, and the banks were raised upon the land to the height of ten feet. The ordinary spring tides flow to the height of sixteen feet, where the sluice is built. In the first year 429 acres of waste land were embanked, in order to be improved; and on it was deposited, in the course of that year, a fine alluvial soil, of the average depth of near three feet. The allotment was sown with oats and seeds in 1823, and the seeds were either mown or depastured in 1824; and it is now sown with wheat, which looks very promising and luxuriant. No part of this allotment of 429 acres yielded any rent previous to this improvement, and now no part of it is let for less than thirty-five shillings per acre. The expense is twenty-one pounds per acre. I am proceeding with two other allotments, containing a great number of acres in each, of which, when finished, I will send you an account, if this be honoured with the approbation of the Society.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* RALPH CREYKE, Jun.

SIR, *Rawcliffe House, March 24, 1825.*

I beg leave to acknowledge the receipt of your letter, dated 1st March. I trust that I shall be able to satisfy the committee that my claim for the large gold medal is strictly conformable to the terms for which they offer it, namely, "for an account of a method superior to any hitherto practised of improving land lying waste."

The superiority consists in creating a fine deep rich soil, more effectually, upon a larger scale, and in a shorter time, than has hitherto been practised. According to the usual practice, the tides were only admitted during the months of August, September, and October; in mine they are admitted the year round. The sluice was not more than five feet wide; mine has two openings of sixteen feet wide. The main drain was only twelve feet wide; mine is ninety feet wide. Not more than fourteen acres were embanked in one piece; I have inclosed five hundred acres in one compartment. Formerly not more than one and a half feet of deposit was obtained; I have got from three to four feet in the same time, upon the increased quantity of land. No levels used to be taken for the formation of the banks; the whole of my embankment has been laid out by the spirit level. Scarcely any inlets used to be made for the purpose of spreading the tide water quicker and more equally over the surface of the land within the embankment, as well as for the more speedy return of it upon the ebb; in my practice innumerable inlets are formed for this purpose. It is quite impossible to give a detailed account of the arrangement of these inlets; they must, in all cases, vary with the shape and different levels of the land embanked, and on that account no exact statement of cost can be given; it is, however, very considerable. The width of the inlets varies from fifty feet to three feet, the depth from seven feet to one foot.

There is much more difficulty in the interior management than any other part; the knowledge of it can only be acquired by practice and close observation. There is likewise a very considerable annual expense in the repairs of the main drain, more particularly of that part near the sluice. A loss of one thousand pounds was experienced the first year, owing to a breach of the bank of the main drain. In my first letter I named 429 acres, at that time growing a fine luxuriant crop of wheat. I now beg to add 500 acres more, at this moment in a state of preparation for being sown with oats and grass seeds this spring; and that 600 acres more will be finished in the course of the present year.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* RALPH CREYKE, Jun.

Queries sent by the Secretary to Mr. Creyke, 1st March, 1825; with that Gentleman's Answers.

1. Expense of erecting the sluice, divided into labour and cost of materials; the nature of such materials, whether brick or stone?

The sluice is built of stone of large size, backed with brick; the foundation was well piled with 550 piles, thirteen feet long, squaring eleven inches, upon which were firmly secured very strong beams; upon the beams the whole space upon which the sluice was built was planked with four inch deals, another set of beams were placed crossways, and then a second floor of three inch plank. Sleeting piles were driven the whole length of the wood work, both fronting the river and next the main drain; a wall is also erected from the sluice to the river, to protect the bank from being injured. The cost of the sluice,

£4,800; the cost of the wall, £300; £340 more for a residence, and stone for materials, for the person attending on the tides, &c. &c.

2. Expense of the main drain?

The expense of the main drain, being three and a half miles long, £7,350, exclusive of the purchase of the land, £4,682; the dimensions of it were ninety feet wide at the surface of the land, eleven and a half feet deep, and thirty feet wide at the bottom; at the width of nine feet from the edge of the main drain is placed the bank, the base of which is sixty feet, and the height ten feet; the bank is made as strong as possible by puddling. The main drain is used as a canal, and is found of great benefit to the lands adjoining.

3. Length, and other dimensions, and materials of the embankment to retain the water on the land to be warped, and cost of the same?

The length of the embankment to retain the tide-water must depend upon the quantity of land embanked; these banks must be well puddled, and made with the greatest care. The dimensions of our banks are thirty-two feet at the base, ten feet high, and six feet wide at the top. The cost of them, three shillings per floor of twenty poles.

4. Elevation of the peat moss above low water at neap tides.

The level of the peat moss varies very considerably; the lowest parts of it are not more than four feet above low water mark; the highest as much as thirteen feet above low water mark.

5. Did the peat undergo any operation of levelling, &c. previous to the water being let in upon it?

The peat moss will, in the first instance, settle very considerably, by the drainage produced by the cutting of the various inlets; and afterwards by the pressure of the soil deposited: it undergoes no levelling.

6. Was the water let on every spring tide, or how

many tides? How long did it remain on the land? How long was it in flowing off the land before the next spring tide was admitted?

Every tide is admitted during the spring tides, and occasionally during the neap tides; care should, however, be taken not to admit any tides when it blows strong, as the banks are subject to great injury at those times, and the warp does not deposit, from the agitated state of the water; the water returns from the land with the ebb. In the river Ouse, at the point where the sluice is erected, the tides flow to their height in three hours, and ebb nine hours. The height is from eighteen feet to fourteen feet.

7. Are there any seasons of the year, or other circumstances, that affect the amount of the silt deposited?

The water in the river will at times be so much affected by land-floods in very rainy weather, that it is not worth admission; in dry weather the amount of silt is nearly the same; in the hotter months the proportion of salt in the silt is greater than at other times.

(CERTIFICATE). *Saltmarshe, near Howden, Yorkshire.*

We, the undersigned, two of his majesty's justices of the peace for the county of York, and residing in the neighbourhood of the peat moss and waste grounds alluded to in a letter from Ralph Creyke, Jun., Esq., to the Secretary to the Society for the encouragement of Arts, &c. &c., dated 18th November, 1824, do certify, that we have seen the said peat moss frequently previous to the improvement by warping, at which time it was of little or no value, and produced no rent to the owners; that we have seen it since the warping was completed; that it is now in a state of cultivation, and capable of producing the most abundant crops of corn, grass, and every other kind of produce.

Given under our hands the 24th Nov. 1824.

PHILIP SALTMARSHE.
ROB. DENISON, Jun.

XLI.—*On the Culture of the Silk-worm.* By JOHN MURRAY, *F. L. S.* &c. &c.

(Continued from page 146.)

HAVING been highly interested in the improved culture of the silk-worm on the principles of Count Dandolo, which I witnessed in full operation in the north of Italy, during the years 1818—1819, I conceived that some succinct notice of a few of the more curious facts connected with the subject would not be unacceptable. For the materials of this paper I am chiefly indebted to the very interesting work of Conte Dandolo, "*Dell' Arte di governare i Bachi da Seta.*" *Seconda edizione, Milano,* 1818.

The hygrometer of Bellani has its *zero* correspondent with that of De Saussure*, and I have converted the thermometric expression of Reaumur, used by Count Dandolo, into the scale of Fahrenheit.

Professor Giobert of Turin informed me, that *the process instituted by the count was universally successful,* though some of the lower class had arrayed themselves in opposition to it, as they did in this country against the introduction of machinery to supersede manual labour,—an hostility which indicated its value. I was informed that the Marchese de la Rovere had no less than *thirty-five ounces of ova* cultivated on these principles, in the year 1819.

The *certainty* to which the process is hereby reduced,—a *certainty equivalent to the culture of an exotic in the conservatory,* is not the least of its recommendations. A solitary blast of the schirroco has frequently destroyed the hope and promise of the year; but all this is now avoided. The average return is more than doubled, and even successional crops may be realized. It is clearly adapted to every climate, even to a higher latitude than ours; and I have no doubt but it is worthy the attention of our enlightened legislature; and while it might add to

* See Vol. VI. page 292, of the *Technical Repository,* for a description of this Hygrometer, in its improved states.

account, no exact statement of cost can be given; it is, however, very considerable. The width of the inlets varies from fifty feet to three feet, the depth from seven feet to one foot.

There is much more difficulty in the interior management than any other part; the knowledge of it can only be acquired by practice and close observation. There is likewise a very considerable annual expense in the repairs of the main drain, more particularly of that part near the sluice. A loss of one thousand pounds was experienced the first year, owing to a breach of the bank of the main drain. In my first letter I named 429 acres, at that time growing a fine luxuriant crop of wheat: I now beg to add 500 acres more, at this moment in a state of preparation for being sown with oats and grass seeds this spring; and that 600 acres more will be finished in the course of the present year.

I am, sir, &c. &c. &c.

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King James the First, of England, in the sixth year of his reign, issued a royal edict recommending the cultivation of the silk-worm, and did all in his power to promote this branch of natural industry, by the issue of packets of mulberry seeds, &c. and a patent was issued to John Appletree, Esq. under the great seal, dated 23d May, 1718, for the planting mulberry trees, the erection of buildings, and the culture of the silk-worm.

The comparative trials of Count Dandolo clearly prove, that the *wild* is decidedly preferable to the *engrafted* mulberry, in the value of the leaves furnished to the silk-worm. The following is the count's conclusion:

"Questi fatti adunque dimostrano che nella foglia tratta dal *gelso selvatico* comparata alla foglia *innestata* avvi sotto ad uno stesso peso copia maggiore di sostanza alimentaria, maggior copia di sostanza resinosa, e meno d'inutile sostanza parenchimosa."

Many different substances have been proposed as a substitute for the leaves of the mulberry, as those of the *lettuce, oak, elm, beet, mallow, rose, spinage, nettle,* &c., but the mulberry stands prominent; though, perhaps, *lettuce* might be used in the *first* period of the evolution from the ova, and until the mulberry puts forth its leaves. Only sixty lbs. weight of leaves were, in 1813, consumed by the young silk-worms, from five ounces of ova, during the *first two* periods. The experiments of Mr. Knight show, moreover, that the mulberry can be easily *forced, and perhaps the same room which contains the ova would subserve this purpose.* In the "*British Review*" of July 1788, a writer recommends the *powder* of dried mulberry leaves; and Bertezen (see "*Thoughts*," &c. London, 1789, p. 22,) tells us, that "*one* lb. of *black* mulberry leaves is worth more than two of white."

Management of the Silk-worms, produced from five ounces of ova.

1813. Days.	Months.	Leaves consumed.	Internal Temperature.	External Temperature.
First Age.		lbs. oz.	Fahrenheit.	Fahrenheit.
1	May 18	*2 14	74.75†	.75
2	19	4 0	74.75	63.50
3	20	8 0	74.75	65.75
4	21	4 14	74.75	65.75
5	22	1 0	74.75	61.25
		20 0		
Second Age.				
6	23	12 0	73.75	63.58
7	24	20 0	73.75	63.50
8	25	22 0	72.50	64.62+
9	26	6 0	72.50	65.75
		60 0		
Third Age.				
10	27	20 0	71.37	
11	28	60 0	71.37	
12	29	65 0	70.25	
13	30	35 0	70.25	
14	31	20 0	70.25	
		200 0		
Fourth Age.				
15	June 1	- - -	70.25	
16	2	65 0	70.25	
17	3	110 0	69.12+	
18	4	150 0	69.12+	
19	5	170 0	69.12+	
20	6	85 0	69.12+	
21	7	20 0	69.12+	
22	8	- - -	69.12+	
		600 0		
Fifth Age.				
23	9	120 0	69.12+	
24	10	180 0	69.12+	
25	11	280 0	69.12+	
26	12	360 0	68	
27	13	540 0	68	
28	14	650 0	68	
29	15	600 0	68	
30	16	440 0	69.12+	
31	17	330 0	69.12+	
32	18	160 0	69.12+	
Fifth Age . . .		3660 0		
Fourth Age . .		600 0		
Third Age . . .		200 0		
Second Age . .		60 0		
First Age . . .		20 0		
		4540 0		
Unconsumed .		475 0		
Lost		350 0		
Total . . .		5365 0		

* The common pound of silk *(libra grossa)* contains eight light ounces.
† Corresponding to 17° Reaumur.

Management of the Silk-worms, produced from five ounces of ova.

1814. Days.	Months, &c.	Leaves consumed.		Internal Temperature.	External Temperature at five o'clock, A.M. Western Exposure.	Hygrometer of Bellani.	Weather.
1st Age.		lbs.	oz.	Fahrenheit.	Fahrenheit.		
1	May 23	1	7	72.50var.	52.25	-	Rain
2	24	2	7	70.25	47.75	-	Rain occasionally
3	25	3	0	70.25var.	43.25	-	Rain and fair
4	26	6	0	69.12	45.50	-	Cloudy & sunshine
5	27	5	0	70.25	50	-	Cloudy
6	28	2	14	71.37+	54.50	-	Rain
		20	0				
2d Age.							
7	29	5	14	70.25	47.75	68	Rain
8	30	11	0	70.25	53.37+	70	Mist and sunshine
9	31	15	14	68	56.75	64	Ditto
10	June 1	15	0	68	56.75	66	Rain
11	2	7	0	68	63.50	66	Rain and sunshine
12	3	1	0	69.12+	61.25	70	Cloudy
		55	0				
3d Age.							
13	4	14	0	69.12	54.50	68	Rain and sunshine
14	5	30	0	68	54.50	69	Cloudy, &c. &c.
15	6	40	0	69.12+	61.25	70	Rain and sunshine
16	7	60	0	69.12+	57.75	75	Rain
17	8	50	0	69.12+	55.62+	74	Rain
18	9	20	0	69.12+	52.25	79	Rain and sunshine
19	10	2	0	69.12+	56.75	78	Ditto
		216	0				
4th Age.							
20	11	50	0	69.12+	56.75	76	Rain and sunshine
21	12	85	0	69.12+	63.50	75	Cloudy, &c.
22	13	120	0	68.	64.62+	71	Fine
23	14	130	0	66.87+	61.25	74	Cloudy & sunshine
24	15	166	0	66.87+	63.50	75	Sun and rain
25	16	70	0	68	65.75	72	Ditto
26	17	5	0	69.12	56.75	70	Fine
		620	0				
5th Age.							
27	18	120	0	68	60.12+	72	Fine
28	19	180	0	68	61.25	73	Rain and sunshine
29	20	240	0	68	56.75	73	Ditto
30	21	310	0	66.87+	59	75	Rain
31	22	360	0	68	56.75	73	Cloudy and rain
32	23	450	0	68	52.25	72	Rain and sunshine
33	24	550	0	68	54.50	74	Ditto
34	25	650	0	68	53.37+	73	Ditto
35	26	500	0	69.12+	54.50	73	Ditto
36	27	280	0	69.12+	54.50	73	Cloudy and rain
37	28	180	0	69.12+	50	72	Rain and sunshine
Fifth Age .		3820	0				

Management of the Silk-worms, produced from five ounces of ova—continued.

	Lbs.	oz.
Fifth Age	3820	0
Fourth Age	620	0
Third Age	216	0
Second Age	55	0
First Age	20	0
Leaves devoured	4731	0
Unconsumed	400	0
Lost	290	0
Total	5421	0

For each ounce of ova 1084 lbs. of leaves have been taken from the tree.

The silk-worms, from five ounces of ova, have consumed the above 5421 lbs. of leaves, and produced 401 lbs. of cocoons, &c.

For each pound of cocoons there have been consumed about 13½ lbs. of mulberry leaves.

The Temperature required for the production of the Silk-worms from the ova, anterior to 23d May, 1814.

1814. Month.	Internal Temperature.	External Temperature.	1814. Month.	Internal Temperature.	External Temperature.
	Fahrenheit.	Fahrenheit.		Fahrenheit.	Fahrenheit.
May 11	63.50	50.26	May 18	70.25	50.00
12	63.50	45.50	19	72.50	50.00
13	63.50	45.50	20	74.75	52.25
14	63.50	45.50	21	77	52.25
15	65.75	47.75	22	73.25	54.50
16	65.75	52.25	23	81.50	52.25
17	68	50.00			

The external temperature was ascertained at five o'clock, every morning, from a western exposure.

During the thirteen days in which the silk-worms were developed from the ova, 134 lbs. of food were consumed. The pound of 28 ounces is to be understood, or 2 lbs. Troy, equivalent to 0.7625 kilogrammes of France.

The following is the daily decrease in weight of 1000 *ounces of Cocoons in a room, the temperature of which was from* 70.25 *F. to* 72.50 *F.*

Day 1st, 1000 oz.		Day 7th, 960	less 6
2d, 991	less 9	8th, 952	less 8
3d, 982	less 9	9th, 943	less 9
4th, 975	less 7	10th, 934	less 9
5th, 970	less 5	11th, 925	less 9
6th, 966	less 4		

So that the 1000 ounces have lost in ten days, during the mutation, 75 ounces. There is a gradual declension for the first five days inclusive, and a regular gradation for the last five days.

8 oz. of ova have lost in 5 days in weight	100 gr.	in 8 days 260,	& in 10 days 440
6 oz.	86 gr.	178,	248
5 oz.	60 gr.	168,	216
4 oz.	80 gr.	181,	224

Each grain contains about 68 ova, and an ounce weight 39,168 ova. The *oncia Milanese* contains 575 grains. The above number is to be understood of *fecundated* ova. Those which are badly impregnated contain 43,060, and are of a *reddish* colour; and of those not at all impregnated, and of a *yellowish* tinge, there are in the ounce 44,100.

The expense of the contingencies of the five ounces of crop, in 1814, *are thus calculated by Count Dandolo.*

Cost of five ounces of ova	15.
Wood for fuel	1.15
5500 lbs. of leaves of the mulberry, at 7 lire per 100 lbs.	385.
Expense of gathering the leaves	96.5
1000 lbs. light and heavy wood, at 32 soldi	32.
Supplemental husks	4.10
Supplemental paper	4.
Oil for light	9.
Preservative Phial	1.10
Daily labour	100.
Lire Milanese	642.
Interest, &c. on capital	90.
Total expense	732.
401 lbs. of cocoons obtained, which, being sold at 78 soldi per lb. produced	1,563.18
Nett profit	Lire 831.18

Note.—A *lira Milanese* is equal to about 8*d.*, and there are twenty *soldi* in a *lira M.*

The calculation, as above, includes not only interest on capital, but a valuation on the mulberry leaves, which is about one-half of the total expense.

The augmentation and diminution of the Silk-worms in weight and size.

Increasing Progression.	Wt.	Increasing Progression.	Size.
100 ova weigh about . .	Grain 1	The ova in the 1st instance, say	1 line
After the 1st change, about	15	After the 1st change, length say	4
2d change, say .	94	2d change . . .	6
3d change, say .	400	3d change . . .	12
4th change, say ..	1628	4th change . . .	20
5th change, say .	9500	5th change . . .	40

Note.—In thirty days the silk-worm has increased in weight 9500 times; and in twenty-eight days the animal has augmented in size about forty times.

The French line is equal to 1.67 lines English, calculating 100 lines English to the inch.

Decreasing progression.

	Grains.
100 silk-worms, at their greatest size, weigh about . . .	7760
100 chrysali weigh	3900
100 females weigh	2990
100 males weigh	1700
100 females, after the ova are deposited, weigh	980
100 females, naturally dead, and the eggs or ova deposited, &c. . .	350

In the space of about twenty-eight days more the silk-worm has diminished in weight about thirty times. Thus the length of the silk-worm, from the time of its greatest increase to the moment it is converted into the chrysalis, has diminished about three-fifths. The chrysalis is the intermediate state between the caterpillar and the winged insect. The *larva* emerges from the ova, spins its cocoon or dormitory, and therein passes into the state of the *pupa*. It finally emerges from thence the *imago*, or winged insect, which dies so soon as the ova are deposited.

Space occupied by each ounce of Ova cultivated.

In the first age on area of square Braccia	4
In the second	8
In the third	19
In the fourth	45
In the fifth	100

Note.—The *Braccio di Milano* is divided into twelve *ounces* or inches, and corresponds to 5.95 palms, which may be calculated at twenty-two English inches nearly.

Amount in weight of Mulberry Leaves consumed by the Silk-worms. 1073 *lbs. of leaves, for every ounce of ova, have been consumed, divided as follows, viz.*

		Leaves, &c. left, destroyed, unused.	
First age, eaten	lbs. 4	First age	lbs. 1
Second	12	Second	2
Third	40	Third	6
Fourth	120	Fourth	18
Fifth	732	Fifth	68
	lbs. 908		lbs. 95

In the course of the management of the silk-worms, the 1073lbs. of leaves from the tree (from evaporation, and other causes) will have lost 70lbs.

Note.—There have been devoured by the silk-worm about 515lbs. of pure mulberry leaves. The 1073lbs. of leaves as taken from the tree will yield 80lbs. of cocoons, calculating from one ounce of ova.

XLII.—*On Climate, with regard to Horticulture.* By JOHN FREDERICK DANIEL, *Esq. F.R.S.*

(*Continued from page* 172.)

ANY position of the surface of the globe which is fully turned towards the sun, receives more radiant heat than it projects, and becomes heated; but when, by the revolution of its axis, this portion is turned from the source of heat, the radiation into space still continues, and being uncompensated, the temperature declines. In consequence of the different degrees in which different bodies possess this power of radiation, two contiguous portions of the system of the earth will become of different temperatures; and if, on a clear night, we place a thermometer upon a grass-plat, and another upon a gravel walk, or the bare soil, we shall find the temperature of the former many degrees below that of the latter. The fibrous texture of the grass is favourable to the emission of the heat, but the dense surfaces of the gravel seem to retain and fix it. But this unequal effect will only be perceived when the atmosphere is unclouded, and a free passage is open into space; for even a light mist will arrest the radiant matter in its course, and return as much to the radiating body as it emits. The intervention of more substantial obstacles will, of course, equally prevent the result, and the balance of temperature will not be disturbed in any substance which is not placed in the clear aspect of the sky. A portion of a grass-plat, under the protection of a tree or hedge, will generally be found, on a clear night, to be eight or ten degrees warmer than surrounding unsheltered parts; and it is well known to gardeners, that less dew and frost are to be found in such situations than in those which are wholly exposed.

There are many independent circumstances which modify the effect of this action, such as the state of the radiating body, its power of conducting heat, &c. If, for instance, the body be in a liquid or aeriform state, although the process may go on freely, as in water, the cold produced by it will not accumulate upon the surface, but will be dispersed by known laws throughout the mass; and if a solid body be a good radiator, but a bad conductor of heat, the frigorific effect will be condensed upon the face which is exposed. So upon the surface of the earth, absolute stillness of the atmosphere is necessary for the accumulation of cold upon the radiating body; for if the air be in motion, it disperses and equalizes the effect with a rapidity proportioned to its velocity.

It is upon these principles that Dr. Wells has satisfactorily explained all the phenomena connected with dew or hoar frost. This deposition of moisture is owing to the cold produced in bodies by radiation, which condenses the atmospheric vapour upon their surfaces. It takes place upon vegetables, but not upon the naked soil. The fibres of short grass are particularly favourable to its formation. It is not produced either in cloudy or in windy weather, or in situations which are not perfectly open to the sky. It is never formed upon the good conducting surfaces of metals, but is rapidly deposited upon the badly conducting surfaces of filamentous bodies, such as cotton, wool, &c.

In remarking that dew is never formed upon metals, it is necessary to distinguish a secondary effect, which often causes a deposition of moisture upon every kind of surfaces indiscriminately. The cold which is produced upon the surface of the radiating body is communicated by slow degrees to the surrounding atmosphere; and if the effect be great, and of sufficient continuance, moisture is not only deposited upon the solid body, but is precipitated in the air itself, from which it slowly subsides, and settles upon every thing within its range.

The formation of dew is one of the circumstances which modify and check the refrigorating effect of radiation; for as the vapour is condensed it gives out the latent heat with which it was combined in its elastic form; and thus, no doubt, prevents an excess of depression, which might, in many cases, prove injurious to vegetation. A compensating arrangement is thus established, which, while it produces all the advantages of this gentle effusion of moisture, guards against the injurious concentration of the cause by which it is produced.

The effects of radiation come under the consideration of the horticulturist in two points of view: the first regards the primary influence upon vegetables exposed to it; the second, the modifications produced by it, upon the atmosphere of particular situations. To vegetables growing in the climates for which they were originally designed by nature, there can be no doubt that the action of radiation is particularly beneficial, from the deposition of moisture which it determines upon their foliage; but to tender plants, artificially trained to resist the rigours of an unnatural situation, this extra degree of cold may prove highly prejudicial. It also appears probable, from observation, that the intensity of this action increases with the distance from the equator to the poles, as the lowest depression of the thermometer which has been registered between the tropics, from this cause, is 12°; whereas, in the latitude of London, it not unfrequently amounts to 17°. But however this may be, it is certain that vegetation in this country is liable to be affected at night from the influence of radiation, by a temperature below the freezing point of water, ten months in the year; and even in the two months, July and August, which are the only exceptions, a thermometer, covered with wool will sometimes fall to 35°. It is, however, only low vegetation upon the ground which is exposed to the full rigour of this effect. In such a situation the air is cooled by the process, lies upon the surface of the plants, and, from its weight, cannot make its escape; but, from the foliage of a tree or shrub, it glides off, and settles upon the ground.

Any thing which obstructs the free aspect of the sky, arrests in proportion the progress of this refrigoration, and the slightest covering of cloth or matting, annihilates it altogether. Trees, trained upon a wall or paling, or plants, sown under their protection, are at once cut off from a large portion of this evil; and are still further protected, if within a moderate distance of another opposing screen. The most perfect combination, for the growth of exotic fruits in the open air, would be, a number of parallel walls, within a short distance of one another, facing the south-east quarter of the heavens; the spaces between each, should be gravelled, except a narrow border on each side, which should be kept free from weeds and other vegetables. On the southern sides of these walls peaches, nectarines, figs, &c. might be trained to advantage; and, on their northern sides, many hardier kinds of fruit would be very advantageously situated. Tender exotic trees would thus derive all the benefit of the early morning sun, which would, at the earliest moment, dissipate the greatest accumulation of cold, which immediately precedes its rise; and the injurious influence of nocturnal radiation would be almost entirely prevented. Upon trees so trained, the absolute perpendicular impression could have little effect; and this might even be prevented by a moderate coping.

Mats, or canvas upon rollers, to draw down occasionally in front of the trees, at the distance of a foot or two from their foliage, would, I have no doubt, be a great advantage in certain dry states of the atmosphere, before alluded to; and, in the case of walls which are not opposed to others, would be a good substitute for the protection of the latter.

Experience has taught gardeners the advantages of warding off the effects of frost from tender vegetables, by loose straw, or other litter; but the system of matting does not appear to be carried to that extent which its simplicity and efficacy would suggest. Neither does the manner of fixing the screen exhibit a proper acquaintance with the principle upon which it is resorted to: it is generally bound tight round the tree which it is required to protect, or nailed in close contact with its foliage.

Now, it should be borne in mind, that the radiation is only transferred from the tree to the mat, and the cold of the latter will be conducted to the former, in every point where it touches. Contact should therefore be prevented by hoops, or other means, properly applied; and the stratum of air, which is enclosed, will, by its low conducting power, effectually secure the plant. With their foliage thus protected, and their roots well covered with litter, many evergreens might, doubtless, be brought to survive the rigour of our winters, which are now confined to the stunted growth of the green-house and conservatory.

The secondary effect which radiation has upon the climate of particular situations, is a point which is less frequently considered than the primary one which we have been investigating, but which requires, perhaps, still more attention. The utmost concentration of cold can only take place in a perfectly still atmosphere: a very slight motion of the air is sufficient to disperse it. A low mist is often formed in meadows, in particular situations, which is the consequence of the slow extension of this cold in the air, as before described; the agitation of merely walking through this condensation is frequently sufficient to disperse and melt it. A valley surrounded by low hills is more liable to the effects of radiation than the tops and sides of the hills themselves; and it is a well known fact, that dew and hoar frost are always more abundant in the former than in the latter situations. It is not meant to include in this observation places surrounded by lofty and precipitous hills, which obstruct the aspect of the sky; for, in such, the contrary effect would be produced. Gentle slopes, which break the undulations of the air, without naturally circumscribing the heavens, are most efficient in promoting this action; and it is worthy of remark and consideration, that by walls and other fences we may artificially combine circumstances which may produce the same injurious effect.

But the influence of hills, upon the nightly temperature of the valleys which they surround, is not confined to this insulation; radiation goes on upon their declivities, and the air, which is condensed by the cold, rolls down, and lodges at their feet.

Their sides are thus protected from the chill, and a double portion of it falls upon what many are apt to consider the more sheltered situation. Experience amply confirms these theoretical speculations. It is a very old remark, that the injurious effects of cold occur chiefly in hollow places, and that frosts are less severe upon hills than in neighbouring plains. It is consistant with my own observations, that the leaves of the vine, the walnut-tree, and the succulent shoots of dahlia's and potatoes, are often destroyed by frost in sheltered vallies, on nights when they are perfectly untouched upon the surrounding eminences; and I have seen a difference of 30°, on the same night, between two thermometers, placed in the two situations, in favour of the latter.

The advantages of placing a garden upon a gentle slope, must be, hence, very apparent: a running stream at its foot would secure the further benefit of a contiguous surface not liable to refrigoration; and would prevent any injurious stagnation of the air. Few situations are likely to fulfill all the conditions which theory would suggest for the more perfect mitigation of the climate in the open air; but the preceding remarks may not be without their use in pointing out localities, which, with this view, are most to be avoided.

Little is in the power of the horticulturist to effect in the way of exalting the powers of the climate in the open air, except by choice of situation with regard to the sun, and the concentration of its rays upon walls, and other screens. The natural reverberation from these and the subjacent soil, is, however, very effective; and few of the productions of the tropical regions are exposed to a greater heat than a well trained tree upon a wall in summer. Indeed it would appear from experiment, that the power of radiation from the sun, like that of radiation from the earth, increases with the distance from the equator, and there is a greater difference between a thermometer placed in the shade, and another in the solar rays in this country, than in Sierra Leone, or Jamaica. The observations of the president of this society upon the growth of pine-apples, is in exact accordance with this idea; for he has remarked, that this species of plant, though extremely impatient of a high temperature, is not by any means so patient of the action of very continued bright light as many other plants, and much less so than the fig and nature, there can be no doubt that the action of radiation is particularly beneficial, from the deposition of moisture which it determines upon their foliage; but to tender plants, artificially trained to resist the rigours of an unnatural situation, this extra degree of cold may prove highly prejudicial. It also appears probable, from observation, that the intensity of this action increases with the distance from the equator to the poles, as the lowest depression of the thermometer which has been registered between the tropics, from this cause, is 12°; whereas, in the latitude of London, it not unfrequently amounts to 17°. But however this may be, it is certain that vegetation in this country is liable to be affected at night from the influence of radiation, by a temperature below the freezing point of water, ten months in the year; and even in the two months, July and August, which are the only exceptions, a thermometer, covered with wool will sometimes fall to 35°. It is, however, only low vegetation upon the ground which is exposed to the full rigour of this effect. In such a situation the air is cooled by the process, lies upon the surface of the plants, and, from its weight, cannot make its escape; but, from the foliage of a tree or shrub, it glides off, and settles upon the ground.

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I come now to the consideration of a confined atmosphere, the management of which being entirely dependent upon art, requires in the horticulturalist a more extended acquaintance with the laws of nature with regard to climate, and greater skill and experience in the application of his means. The plants which require this protection are in the most artificial state which it is possible to conceive; for, not only are their stems and foliage subject to the vicissitudes of the air in which they are immersed, but in most cases their roots also. The soil in which they are set to vegetate is generally contained in porous pots of earthenware, to the interior surface of which the tender fibres quickly penetrate, and spread in every direction; they are thus exposed to every change of temperature and humidity and are liable to great chills from any sudden increase of evaporation. This part of the subject naturally divides itself into two branches. The first regards the treatment of such exotics as are wholly dependent upon the artificial atmosphere of hot-houses: the second refers to the management of those hardier plants which only require to be preserved in green-houses part of the year, but during the summer months are exposed to the changes of the open air. I shall first offer a few remarks on the atmosphere of a hot-house.

The principal considerations which generally guide the management of gardeners in this delicate department, are those of temperature; but there are others, regarding moisture, which are, I conceive, of at least equal importtance. The inhabitants of the hot-house are all natives of

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XLIII.—On Turning Tools. By the EDITOR.

(Continued from page 138.)

WITH A PLATE.

IN page 2 we described a wooden stock or handle for holding turning-tools in, having *a guiding-handle by which to govern the position of the tools.* We shall now proceed to show other contrivances for effecting the same desirable object.

Mr. G. Manwaring's Handle and Guide.

He prefers, for the large and long handles of his turning-tools, to use the well seasoned spokes of carriage-wheels when broken up. These are made of ash, and are of a kind of oval shape, as shown in fig. 1 of plate VIII. He surrounds the end of the handle next the tool with a loop of iron, ending in a stem, driven into a file-haft or handle, thus making it serve the double purpose of a ferrule and a guiding handle. Fig. 2 is a side view of these parts.

A Manchester Guide-handle.

A still more effectual guiding-handle the Editor saw in the hands of the workman from Manchester, mentioned in page 1, *it being applied immediately upon the tool itself,* and not upon the stock or handle, as in the two cases described. It was applied to a three-square turning-tool used for the opening holes in the lathe, in the manner shown in fig. 3, where *a* represents the body to be turned, *b* the turning tool, *c* the guiding-handle, *d* a dotted circle representing the long handle of the tool, and *e* part of the lathe-rest. Fig. 4 shows the form of this useful tool.

The EDITOR'S *Guiding-handles.*

The Editor, taking the hint from the last mentioned guiding-handle, thinks its services ought by no means to be limited to that particular application of it, but to be exorange-tree: and he is inclined to think, that, on this account, they may be found to ripen their fruit better in the spring than in the middle of the summer. This energy of the sun is at times so great, that it often becomes necessary to shade delicate flowers from its influence; and I have already pointed out a case in which it would be desirable to try the same precaution with the early blossom of certain fruit trees. The greatest power is put forth in this country in June; while the greatest temperature of the air does not take place till July. The temperature of summer may thus be anticipated a month, in well secured situations.

The greatest disadvantage to which horticulture is subject in this climate, is the uncertainty of clear weather; a circumstance which art has, of course, no means to control; no artificial warmth is capable of supplying the deficiency when it occurs; and without the solar beams fruits lose their flavour, and flowers the brightness of their tints. It has been attempted to communicate heat to walls, by means of fire and flues; but without the assistance of glass, no great success has attended the trial.

It is well known that solar heat is absorbed by different substances, with various degrees of facility, dependent upon their colours, and that black is the most efficacious in this respect. It has therefore been proposed to paint garden walls of this colour; but no great benefit is likely to arise from this suggestion. It is probable that, in the spring, when the trees are devoid of foliage, the wood may thus be forced to throw out its blossom somewhat earlier than it otherwise would do; but this would be rather a disadvantage, as the flower would become exposed to the vicissitudes of an early spring. It is more desirable to check than to force this delicate and important process of vegetation, as much injury may arise from its premature developement. When the tree has put forth its foliage, the colour of its protecting support can have no influence in any way; the leaves cover the surface, and absorb the

XLIV.—*Observations on the Steam-boats of the United States of North America and Canada.* By Professor SILLIMAN*.

"THE carriage and horses were received on board the steam-boat at Whitehall†, an accommodation we had not expected, and thus we avoided the inconvenience of having them go round by land to Burlington, in Vermont, to wait our return from Canada. The steam-boat lay in a wild glen, immediately under a high, precipitous, rocky hill, and not far from the roaring outlet of Wood Creek; we almost drop down upon the port all on a sudden, and it strikes one like an interesting discovery, in a country so wild and so far inland as to present, in other respects, no nautical images or realities.

"We left Whitehall between two and three o'clock in the afternoon, in the Congress, a neat and rapid boat, and the only one remaining on the lake since the late awful catastrophe of the Phoenix.

"The recent loss of the Phoenix, and the tragical events by which it was accompanied, might well have caused us some anxiety in the prospect of a night passage on the lake; but the weather was fine, and the water smooth, and we had a good boat, furnished with a gentleman's cabin on deck. As I was, however, scarcely able to sleep at all, I passed most of the night in the carriage, both as being a pleasant situation, and as affording me some opportunity of observing the fire, the management of which I was willing enough to see. I am sorry to say, that I was disappointed in not observing that anxious vigilance, which, after the late dreadful occurrence, we should naturally expect to find. Large piles of pine wood, very dry of course, and also very hot, from their being placed near

* From his "Remarks made on a short Tour between Hartford and Quebec, in the Autumn of 1819."

† A port on Lake Champlain.

the furnace and boilers, occupied the middle of the vessel. A candle was placed by one of the people on a projecting piece of this wood. It had burned nearly down, and a fresh north wind blew the flame directly towards, and almost against, the pine slivers, which were, as before said, very dry, and also full of turpentine, and therefore in a condition to catch fire with the greatest ease! Happily, from the contiguous carriage window, my friend Mr. W—— observed this threatening candle, and, after some importunity with the people, (who seemed very indifferent to the danger), succeeded in having it removed. It might otherwise very naturally have caused the Congress to share the same fate with the Phoenix, which was burnt by a candle, placed in a situation of less apparent danger; that is, near a shelf in a closet, where it communicated fire to the board*.

"We found one other unpleasant circumstance: the boat stopped several times, at different places, on the two shores of the lake, to deliver and receive freight: and our captain being extremely dilatory, we were delayed one and two hours at a place.

"At three o'clock in the morning we stopped at Burlington, and left the carriage and horses till our return from Canada.

"Our passage down the remainder of the lake was very rapid, and we soon arrived at the American custom-house; the boat was visited, but our baggage was not examined, and we were treated with the greatest civility.

"This ceremony (for it was a *ceremony* merely) being over, we were very soon abreast of the great stone castle, erected by the American government on Rouse's Point, upon the western side of the river Sorel or Richelieu, and was designed to command the communication between that river and lake Champlain. In consequence of a late determination, that the boundary line (the 45th degree of

* On our return, we found the Congress under a new captain, and a much more strict police, which left no further room to complain of negligence.

latitude) passes a little south of this castle, it now falls to the British Government.

"The current favoured our progress, and we pushed on very impetuously through the quiet waters of this very considerable river, whose smooth surface was thrown into waves by our rapid course.

"We both left and received passengers at the *Isle aux Noix*, eleven miles from the frontiers, and eight or nine from St. John's, but without going ourselves on shore; and less than one hour from the time we left it brought us to the wharf at St. John's in Lower Canada.

"The river St. Lawrence, the mighty outlet of the most magnificent collection of inland waters in the world, the North American lakes, individually like seas, collectively covering the area of an empire; already enlivened by the sails of commerce, bordered by thriving villages and settlements, and hereafter to be surrounded by populous towns, and cities, and countries; associated as this river is with such realities, and with such anticipations, it is impossible to approach the St. Lawrence with ordinary feelings, or to view it as merely a river of primary magnitude.

"Already the two great cities of Canada are erected on its borders; Europe sends her fleets to Quebec, and even to Montreal; nearly two hundred miles of intervening water are now daily passed between the cities by steam-boats, some of which are as large in tonnage as Indiamen or sloops of war. It is now no very difficult task to be wafted on the St. Lawrence from lake Ontario to the ocean, a distance of nearly seven hundred miles, or from Niagara, which differs little from one thousand; and the entire range from Lake Superior is two thousand!

"The current is considerable, probably three miles an hour generally, but in some places it has apparently double that force; and the river, instead of flowing, as it commonly does, with an unruffled surface, becomes perturbed, and hurries along with murmurs and eddies, and in a few places with foam and breakers.

"This is particularly the case at the Richelieu rapids, fifty miles above Quebec, where the river is compressed within half a mile, and the navigable part within much less; numerous rocks, which appear to be principally large rolled masses, form, when the water is low, as it was when we passed, a terrific reef, and when the river is up a dangerous concealed enemy. Through these rapids the steam-boats dare not go in the night; and the instance in which it is said to have been done was to carry to Quebec the news of the Duke of Richmond's death.

"The speed of the steam-boat had, however, been surpassed by that of the land messenger, who had already arrived with the gloomy news. At the lower end of the town of Montreal, the stream, compressed by the island of St. Helena, is so impetuous, that the steam-boats, which every where else can stem the current, are here obliged to anchor, and procure the aid of oxen; four yoke were employed, with a drag-rope, to draw the Malsham—the boat in which we came up to Montreal—through this pass; it is, however, not half a mile that the river is so rapid, for after passing this place steam carries the boats on again to their moorings, at the upper end of the town. It requires a very strong wind to carry vessels with sails against this current. I saw some vessels here which enjoyed this advantage, and for one hour I could not perceive that they made any head-way.

"Although there are roads, said to be good, on both sides of the St. Lawrence; it was, till within five or six years, a considerably arduous undertaking to travel backwards and forwards between the two cities of Canada. By land, in the slow Canadian calash, it was tedious; and although *down* the river from Montreal to Quebec it was obviously no difficult thing to go with the current, to return by water was always difficult. With head winds it was of course impossible to *ascend*, nor with strong head winds could they always *descend*, even with the aid of the stream.

"Quebec and Montreal were therefore a great way apart, as regarded facility of intercourse; now they are, in this respect, very near, and it is possible to visit either city from the other, quite comfortably and at ease, to transact business and return, within the period of four days, although the distance is one hundred and eighty miles. This wonderful facility has been imparted by steam-boats, of which no fewer than seven now ply between Montreal and Quebec; they are named, Malsham, Swiftsure, Lady Sherbrook, Quebec, Telegraph, Car of Commerce, and Caledonia.

"The burden of the Malsham is upwards of six hundred tons, and that of the Lady Sherbrook was stated to us at eight hundred; these are the largest, and most of the others are considerably smaller.

"They are built with deep holds for freight, which appears to be much more an object with them than passengers. Going down in the Swiftsure, of between three and four hundred tons, we had but about a dozen cabin passengers; and returning in the Malsham we had but four. The accommodations are good, and the provision for the table ample; for dinner it is luxurious; there is a lunch at noon, for dinner is at four o'clock, and tea at eight; breakfast also at eight o'clock.

"The captains of the boats partake in all the good things; some of them, at least, are convivial with their guests, and sit long to drink wine, which is the common practice in Canada.

"Some of them appear to be in danger from repletion; they have but little bodily exercise, and swimming, as they do, in a sea of luxury, it is not extraordinary that they exhibit the physical effects of good living; they are, however, very obliging and courteous to their passengers, who are made perfectly comfortable on board of their boats.

"The machinery is situated deep in the hold, and appears but little above deck; this circumstance, with the depth of the hull, and the burden of freight which the boats carry, causes them to move much more steadily than ours of the United States do.

"On board of the Malsham *we could scarcely perceive the jar of the machinery!* There being no ladies on board, Mr. W—— and myself were permitted to appropriate the after cabin, a very good room, where, with a comfortable fire, we enjoyed even domestic retirement, and were allowed to occupy our time as we pleased.

"We were told that the Lady Sherbrook was the finest boat in the line, but we were not on board of her.

"The fuel for the boats costs about two dollars and fifty cents the cord; and they stop twice, once at Sorel, and once at the Three Rivers, to take it in.

"The passage costs ten dollars down to Quebec, and twelve returning; we were on board two nights and one day in going down, and two days and three nights in returning. But a part of two of the nights in the last, and one of them in the first, was spent in the dock.

"Steam-boat business has been very profitable on this river, but is said now to be otherwise, owing principally to its being overdone.

"The catastrophes produced by the explosion of the boilers of steam-boats having now become rare, the attention of the public, in consequence of several unhappy occurrences, and especially of the late dreadful one on lake Champlain, has been directed to the dangers of fire. The active volcano which the steam-boat carries in her bowels, seems sufficiently apalling, and few persons, when first beginning to travel in this way, can lie down to sleep without deeply pondering that a furious imprisoned enemy is raging within the combustible vehicle that bears them along; and that both fire and water, usually foes, but here leagued in unnatural alliance, may conspire for their destruction! Rarely, however, does it appear to have occurred to the traveller, that the most serious danger (as the thing is *actually* managed) really arises from that negligence, and presumption, and apathy, which destroy so many buildings, so much property, and so many lives on shore.

"I am sorry to say, that in the boats on these northern waters, there is not that degree of care and anxious vigilance which the case certainly demands, where so much property and so many lives are at stake. The Phœnix, as I have before observed, was, without doubt, destroyed by a candle; still candles are negligently left on board of most of the boats in the northern waters; fires and candles are not adequately watched in the St. Lawrence; and we have seen, in one of the Canadian boats, a fire made in an open stove, standing without a chimney on the naked deck; while coals were every moment blowing against pine spars, and falling on the deck, which was made of dry pine, and covered with pitch! We were also exposed to danger from another very unexpected incident. On our passage up the river, in a north-easterly storm, just as we were entering the Richelieu rapids, where we needed all our power to stem the current, and any disaster would be peculiarly embarrassing, we were pressing on, not only with powerful steam, but with a strong and fair wind, which strained every thread of our large square sail, the only one which we carried; our mast, apparently about fifty feet high, and of proportionate diameter, was, it seems, only feebly braced from the bow, although perhaps sufficiently in the other direction.

"The captain, having been up the preceding night, was asleep below; I was on deck, and observed that our mast, with its feeble shrouds, was strained to the utmost, and felt some anxiety lest it should fail. Going below, I was scarcely seated before a crash and an outcry brought me again upon deck.

"The wind, it appears, suddenly shifted round; and a violent squall from an angry cloud instantly threw the sail all aback upon the mast, and there being no adequate stays or braces to sustain the solitary pine, it snapped like the stem of a tobacco pipe; the two chimneys were a few yards behind it; and the heavy spar, which supported the sail at top, falling violently across one of them, was broken quite in two; the mast also, in its fall, broke the horizontal iron rods, which crossed each other, and were fastened to some high frame-work, to sustain the chimneys; the sail fell over the mouths of both chimneys, and shut them up completely; and from the top of one of them, sustained by the cords which fastened them to the sail, hung the two broken pieces of the yard, probably forty feet in length.

"The captain could not be immediately found: the Canadian seamen who managed the boat vociferated most furiously in French, but seemed utterly confounded, and without resource; and some feeble attempts which they made to disengage the sail from the chimneys only pulled it more entirely over them. In the mean time, the wind, which continued to blow violently, jerked the sail and its broken spars with so much force, that there was much danger that the chimneys would go by the board; in which case our furnaces, being in full action below, would throw out their flames immediately upon the deck, and upon the tierces of gin with which it was covered, even close to the chimneys! There appeared to be nearly one hundred of these tierces; and the explosion of any one of them, which would probably occur if struck by the fire, would involve us in sheets of flame; and should we even succeed in extinguishing the fire, our boat, without either steam or sail, would be completely unmanageable, and be liable to be wrecked at the foot of the rapids!

"In this moment of anxiety, (while a poor Scotch emigrant, whose all was on board, was weeping and wringing his hands, and exclaiming that we should all be lost), the captain arrived on deck. The wind galled the sail across the top of one of the chimneys, (which was cut into points like a picket-fence), so that the canvas was soon completely perforated, and the chimney stood up through it. The other chimney was so battered by the fall of the yard, that it could not pierce the sail; especially as it was guarded at that part by a strong rope, and every effort to disengage it failed. It was easy to foresee what must follow: the sail, which being wet with rain, for some time resisted the heat, now became so dried that it took fire and blazed. The captain sent up one of the sailors to cut it away; and the man, with sufficient hardihood, crawled up, and worked where it was on fire all around him. At length, by burning, it fell from the chimney, and we were extricated from our unpleasant situation. If, however, the sail, the fuel on deck, and every part of the boat had been dry; and, especially, had the accident occurred in the night, the consequences might have been very painful. But there was an eye superior to human vigilance which watched over our safety!

"Immediately after this accident we had a good proof of the manner in which science and art can sometimes triumph over the obstacles of nature. We entered the rapids of Richelieu, not only with an opposing current of great strength, but with a strong head-wind; but still, by the force of steam alone, we fought our way through, and indeed the same wind continued during the remainder of the passage.

"The long twilight of this climate, which in a degree compensates for the shortness of the days, was exhausted; the cottages and villages on shore cast their evening lights on the river; the waning moon, reduced to less than half her full size, had just risen above our stern, and cast a feeble radiance on the flood and the shores; the stars, unobscured by a single cloud, were bright as gems in the azure vault; the galaxy was delicately traced across the sky—all was stillness, except the dashing of the water-wheels, the cry of the sternsman, and the occasional song of the Canadian boatmen; when the *aurora borealis* appeared, under circumstances which I never before witnessed.

"Not only was there a delicate glow in the lower part of the northern portion of the sky, similar to that seen through a transparency, but there were shoots of light darting upwards, like very feeble flames, now elongating, now receding, and changing their places.

"After being a little while below, I was delighted on returning, to see a zone of light passing through the zenith, *extending across the entire heavens,* intersecting the milky-way very obliquely, greatly surpassing it in brightness, and forming a beautiful glowing belt!

"At this moment our two chimneys emitted volumes of smoke succeeded by flame; and a long stream of brilliant sparks, carried far astern by the wind, illuminated the deck and the water.

"The Lady Sherbrook steam-boat, going down the river, glowing with lamps, and streaming with fire, now moved majestically by us, and seemed a floating and illuminated castle. Loud vociferations of nautical French, from both boats, were soon lost in the rapidly increasing distance; while the lovely belt in the heavens, beginning to break, and hanging here and there in pale patches of light, finally vanished, and resigned the sky to the moon and the stars."

XLV.—*On improved Melting-pots for Brass, &c. to withstand the action of Fluxes. By the* Editor.

The Editor lately mentioning to an intelligent workman in brass, pinchbeck, gilding metal, &c., and who is also a maker of spelter solders *, the melting-pots for cast-iron made by Mr. Anstey, and described in our present number, he said they might answer very well for cast-iron, but would not serve by any means for alloys of copper and zinc, nor where fluxes were used, by reason of their *porosity*.

He stated, that he found it necessary to form his own melting-pots of one half new Stourbridge clay, one quarter of broken melting-pots, one eighth of hard coke, and (less

* For the compositions of spelter solders, and the methods of making and granulating them, see Vol. I. *Technical Repository*, page 432.

the purpose of closing the pores) one eighth part of pipe-clay.

He also, *for the sake of giving them a greater degree of compactness*, adopted the excellent plan recommended by the celebrated Glauber; namely, that of *forming them in metal moulds, strongly compressed by the action of a screw-press.*

He said, that provided they were kept continually hot, his melting-pots would serve for a fortnight, and neither zinc nor fluxes would make their way through them.

In making his alloys of copper and zinc, he first melts his copper covered with a flux of common salt or nitre, and then thrusts the zinc down below the surface of the melted copper, and he thus avoids the loss of the zinc from its oxidation.

XLVI.—*On Mr.* Tuther's *Wind-furnaces.*

Besides cutting off the connection between the internal lining of Stourbridge bricks and the outward walls of his furnace, he interposes between them a thickness of two inches of charcoal, in coarse powder *, *acting as a slow conductor of heat*, and can thus get his furnace up to a heat in much less time than if, as usual, he had to heat the adjoining mass of brickwork also.

He has also contrived a loose brick to take out occasionally in the front of his furnace, immediately above the bars, in order to remove any clinkers which might clog them up and obstruct the free passage of air through them. These two suggestions he has adopted at the recommendation of Mr. Duncan Campbell.

He has likewise added a side chamber adjoining to his furnace, and through which the heated air passes in its way to the chimney, as recommended by Dr. Henry, and

* For a similar application to lime-kilns, by the late Earl Stanhope, see Vol. IV. *Technical Repository*, page 227.

which he finds exceedingly convenient for a variety of purposes, where a moderate heat is sufficient.

Mr. Tuther, on his lately removing to new premises in High Holborn, a few doors only from his former residence, where he had carried on his business of an optician, philosophical instrument maker, and preparer of chemical tests, for many years, with great success, determined to adopt these improvements in his wind-furnaces, as well as others also in his sand-bath and other furnaces employed by him in his laboratory, but which, however, are not yet completed.

XLVII.—*On the advantages of steaming and boiling Food for Cattle.*

MR. C. WHITLAW, in his late travels through the United States, was particularly struck with the very superior richness and quality of the milk he was furnished with at one of the inns; on questioning the landlord, he referred him to the person who supplied him with the milk, who informed him that *he fed his cows with the coarse hard stems of grasses, which were constantly refused by cattle in general, on account of their destroying their teeth!* This, of course, excited his farther attention; and on enquiry, it turned out that the farmer rendered these harsh, though exceedingly nutritious grasses, palatable to his cows, *by first subjecting them to the action of steam.*

He effected this desirable object by enclosing the grasses in close wooden chests, with false bottoms, perforated with holes, under which he admitted the steam from a boiler.

This practice has been long ago adopted in this country by J. C. Curwen, Esq. M.P., in the preparation of potatoes, by means of steam, for feeding cattle, and with the most complete success; and he afterwards applied the steam to hay, &c., and even made decoctions of them.

The American farmer likewise added cut or chopped straw to his grasses whilst steaming them, and fed his cows therewith.

The rank coarse grasses of the marshes, which can only be eaten by those cattle whose teeth have been accustomed to them, but which are exceedingly nutritive, might, doubtless, by steaming, be rendered a valuable food to cattle in general.

Mr. Franklin, an extensive dairyman near London, adopted Mr. Curwen's practice with complete success: and, indeed, where fuel is not too expensive, there can be no manner of doubt, that steaming and boiling the hard stems of grasses, chopped straw, and other similar food for cattle, must render them much better adapted to give out their nutritious qualities than when employed in their raw state.

XLVIII.—*On a singular mode of making Earthen Floors in Derbyshire. Communicated to the* EDITOR *by Mr.* WILLIAM DUESBURY, *of Bonsall.*

THESE floors are formed of the vitreous slag, from the bottoms of the reverberatory furnaces, where lead ores are smelted, and which slag is beaten to a coarse powder under the stampers of the buddling mills, in order to extract, by washing over, any grains of lead it might contain. Of this pounded slag four parts by measure is to be taken, and one part of carefully slaked lime; the whole being uniformly mixed to a proper consistence with water, is spread, if for a ground floor, upon a layer of broken cinders; and whilst drying is, from time to time, well beaten with a flat wooden beater, to give it a due degree of hardness. When nearly dry, it is smoothened and glazed, by repeatedly passing all over it a flat and heavy boulder stone, having a handle fixed to it. If for an upper floor a layer of straw is first spread over the supporting boards of the ceiling, and the composition laid upon it, in the manner already described.

These floors are exceedingly durable, and indeed we have heard of an upper floor of a small room at Bonsall, only two and a half inches in thickness, actually remaining firm, without any thing to support it, the slight rafters originally formed of coppice-wood having become decayed in the course of time! The floor is, however, made slightly convex or arched, which no doubt assists in giving it additional strength.

These floors are totally different from those commonly made in Derbyshire, with calcined gypsum, or plaster of Paris.

There is no doubt but that the vitreous slag from iron and copper works might equally well be made into floors with lime, as this from the lead works.

XXXVI.—*Observations on the Culture of Silk. By the late* ARCHIBALD STEPHENSON, *Esq. of Mongreenan, in Ayrshire.*

(*Continued from page 190.*)

HAVING kept them in this situation for eight or nine days, you must then put your different divisions of eggs into little pieces of old linen cloth, which must be washed thoroughly clean for that purpose, as the least dirtiness in the cloth would prove prejudicial to the eggs; each piece of cloth should be of the size of a foot square: turn up the ends of the piece of cloth, and tie them with a bit of thread, as near to the top or end as possible; by means of which the eggs will lie loose, and can be shook, and turned from time to time, without untying the knot: replace these packets in the basket, and cover them up as before, turning and shaking the seed in the packets three or four times a day, that it may receive the heat equally.

On putting the eggs into these packets, increase the heat to 14½ degrees of the therometer, and keep up that heat night and day, as equally as posssible; for which purpose, have a couple of thermometers in your room for your direction. After the eggs have remained in the little packets for three or four days, increase the heat to 15 degrees; and in four days more, if the weather seems settled, and very promising, increase the heat gradually to 16 degrees, visiting and turning the eggs from time to time as before.

When the eggs begin to turn white, and the mulberry trees are so far advanced as to be out of danger from cold winds, or slight degrees of frost, increase the heat gradually to 17½ degrees, or 18 degrees at most, to quicken the hatching of your eggs, and to make the worms come out as nearly at the same time as possible. But never increase the heat to more than 18 degrees, because a greater heat never fails to push the worms too fast, and to render them red at their first coming out.

When the worms are red at their first coming out it is a sign the eggs have either been bad, or ill kept over winter, or overheated; that is, too much forced when laid to hatch. Worms of this colour are good for nothing, and are therefore to be thrown away, to avoid the expense of feeding them, since they will never produce cocoons.

When the worms are entirely black, upon their first appearance, it is a sign of their having been perfectly well managed, which gives great hopes of success.

When the eggs first begin to take a white colour, put them into little chip boxes, and cover each box with a bit of clean white paper, pricked with many little holes in it, to allow the worms to come through, taking care to inspect and shake the eggs from time to time in the boxes, that they, may have equal access to the heat; and when the worms are ready to appear, put a few mulberry leaves upon the paper, to which the worms will readily attach themselves as they come out; and, by means of the leaves, you can easily take out the worms as they appear, in order to put them into different little boxes, and then give them some of the tenderest leaves, cut into small pieces, to feed on, giving them at the rate of three meals each day.

As the leaves when very young will dry so much, even in an hour's time, if exposed to the open air, as to be unfit for the use of the young worms, you must put them into a clean glazed pot; but take care to place them loose, that they may not press too much upon each other; cover the head of the pot with a wet linen cloth, and place the pot in a vault or cellar; or, in case you have none, into the coolest part of your house; by which means the leaves will keep fresh and good for two or three days together. Besides, you must take care to have always in the house at a time, a stock of leaves sufficient at least for three days' provision for your worms, to secure you in food for them during such length of time, in case of wet weather; as nothing is more pernicious to the worms than giving them wet leaves for their food; for which reason be careful never to pull the leaves when wet, either with rain or dew, except on absolute necessity; and in that case you must spread them out, and turn them, from time to time, with a long wooden fork, that the leaves may be perfectly dry before you give them to the worms.

It may here be added, that it is the general opinion in France that the leaves afford a more wholesome food for the worms when they have been gathered four or five hours fresh from the tree; and more particularly so if the trees grow upon any soil other than sand or gravel; because the keeping them so long so far diminishes the over-richness of the leaf. The persons employed in pulling the leaves must be careful to have their hands clean, and free from every strong offensive smell, such as that of garlick, onions, or tobacco, &c.; and they ought to be particularly attentive not to bruise the leaves in pulling them.

When your worms are first hatched, keep each day's production separate by themselves, as it is of high consequence to have each parcel brought up as equal as possible, that all the worms contained in it may be in readiness to mount for making their cocoons at one and the same time. After setting apart separately the production of each of the first four days, what then remains of the eggs to be hatched may be thrown away, as these later worms are always found to be weakly, few of them completing their cocoons; so that the attempt to rear them is always attended with an unnecessary waste of leaves, besides the trouble they occasion to no purpose.

When the worms are just come out, keep them in a heat not exceeding 15 degrees; and even then there is no occasion to cover them by putting on the heads of the boxes, as it is better for the worms to have abundance of free air. But if the weather should happen to prove cold, you must in that case put on the heads of the boxes at night, or cover them with a double napkin, taking care, however, not to let it touch the worms, for fear of hurting them, and take off the head of the box or napkin in the morning, when you give a feed to the worms, as early as you can, at four or five o'clock, but not later than the last. In that early state, the three different meals should be given to the worms at the distance of six hours from each other.

When the worms are coming out, they are not to be left scarce a moment, as they ought to be gathered from the boxes as fast as they make their appearance; and as this work goes on in the night as well as the day, it becomes a very hard task at that time. Monsieur Marteloy, the gentleman already mentioned, who always carefully attended to this particular himself, generally went to bed at nine o'clock in the evening, during this critical period, and got up again at midnight, which was quitting them as little as possible. But this great attention at this time is only requisite in large operations, for example, a pound of eggs, or any quantity above it.

Before proceeding to the further treatment of the worms newly hatched, it may be proper here to give some description of the stage and baskets necessary for the carrying on of this culture, as these ought to be in readiness some time before they are wanted.

The stage ought to be erected in a large room, with windows on each side of it, so as to be able to command a thorough air when necessary, the walls and floor of which should be examined with the strictest attention, in order to fill up every little hole or crevice than can give access either to rats or mice, as both these animals eagerly devour the silk-worms whenever they can find an opportunity for that purpose.

In Lauguedoc and Quercy they make the stage six feet, but more frequently only four feet and a half broad, so that a person, by going first to the one side, and afterwards to the other, may be able with ease to reach over the whole breadth, both for the advantage of giving the leaves to the worms, and for clearing away their litter more easily. At every nine feet distance in the length of the stage, they fix a post in the floor, of a height sufficient to support the roof, and to those posts they nail a piece of wood across the stage, which piece of wood serves to support the baskets to be hereafter mentioned, which rest upon the cross bars of wood at the two ends: so that these bars ought to be four inches broad, which allows two inches for each basket to rest on, as the baskets join the one to the other at the cross bars. The stage being four feet and a half broad, takes two of these baskets to fill up its breadth. They make their stage to consist of as many shelves as the height will admit of, keeping them at the distance of twenty inches from each other. The lowest table or shelf ought to be made six inches broader than the shelf immediately above it, that the lowest may project three inches on each side further than the one above it; and so on in proportion with all the other tables or shelves; the uses for making this difference of breadth in the different shelves shall be afterwards particularly explained.

It has been already observed that rats and mice are extremely destructive to the silk-worms when they can get access to them; for which reason every precaution should be used to protect them against such dangerous visitors. For this purpose, therefore, the following one is generally attended to. They cover the foot of each of the posts of wood which support the stage with a piece of strong smooth paper, which is nailed to the wood with tacks, to the height of a foot above the floor; by which means, when these vermin attempt to mount, their feet slide upon the paper, so that they can get no hold. A hoop of glass of the same height, made of a size proper for the wood, might, perhaps, be found to answer the purpose better, though I was assured the paper had the full effect for which it was intended. The ant, or pismire, is also a most dangerous enemy to the silk-worms; to guard them from which, the usual practice, where there is any danger from these insects, is to put a quantity of hot lime round the foot of each of the posts which support the stage, which fully answers for that purpose. Cats and poultry of all kinds are likewise destructive to the worms, and must therefore also be guarded against with care.

When the worms are young, they are put into wicker baskets, three feet long, and eighteen inches broad, the edges or sides of which are made from two to three inches high. They make them of that size in order to be the more portable.

When the worms come to be placed upon the stage, they are put into baskets four feet and a half long, and two feet three inches broad, and the sides or edges of them are from two to three inches high, and of the thickness of about three quarters of an inch. The bottoms of the baskets are made of plaited reeds, after being split in order to make them lie flat. They are bound all round with a slip of wood a little more than an inch broad, and about a quarter of an inch thick, to keep them together, which is nailed down, and three cross bars of wood are nailed across the back of each basket to keep it firm.

With respect to the stages, all those I have seen appear to me to be rather too broad to admit of people working with that ease which is requisite. I should therefore incline to think, that in place of one broad stage in a room, of six feet, or even four feet and a half, which I have observed to be the narrowest in use in France, it would answer the purpose better to make two stages of three feet broad each, with a passage betwixt them of three feet broad, and a like passage of three feet upon each side of the room next the walls; together with another passage of the like dimensions at each end of the stages, by which means all your people could go about and work with ease, without incommoding each other, and, indeed, without being hampered in any shape whatever. Besides, the stages being only three feet broad, must be a great advantage at the time of mounting, (of which afterwards), because in that case the heat of the cabins in which the worms make their cocoons cannot be so great as must be the case when the stages are six or four feet and a half broad, as the fresh air must have much more easy access to pass through them; a circumstance of the highest importance, particularly at the time of mounting, as the weather, from the advance of the season, must then be greatly hotter than at any other preceding time during the whole course of the cultivation.

Both in Languedoc and Quercy I have seen baskets used nine feet in length, and four feet and a half broad, which exactly filled up one division of a shelf of the stage. But I could not by any means approve of baskets of that size, as they appeared to me to be extremely cumbersome and unwieldy; besides that, from their great length, and the necessary slightness of the materials, they were very apt to ply and bend down in the middle, and for that reason were, in my opinion, to be avoided. In short, I regarded them as being greatly inferior to the smaller baskets above mentioned, as to real use and convenience.

It is proper to observe, that care should be taken to place the stage in such a position as not to allow the sun to dart directly upon the worms, as they are not able to bear the heat of it in this manner when it is great. It will even kill them, especially when they are young; and if it should not go that length in a colder climate than the south of France, it will, notwithstanding, have the effect to torment them, and render them very unquiet, and prevent them from eating with their usual appetite. If the sun darts upon them when they are large, you will see them fly from it as fast as they can, and seek for shelter in the shade, even at the expense of the want of their food. When young they are not able to get out of the way, and by that means are often killed by it, as above mentioned.

In place of the wicker baskets already described, I observed a very simple and good contrivance practised at Montauban, in Quercy. They take a barrel hoop, which they form into a circle, fixing it with packthread or twine, after which they bind across the bottom eight or nine rows of reeds, both ways, by which means the bottom is thrown into little squares, tying the reeds not only to the sides of the hoop, but fixing them also in all the different places where the reeds come in contact with one another. This forms a sort of basket, which is extremely light and handy; and besides, as the reeds stand at a good distance from each other, it gives much more air to the worms, which is a great advantage. After making their baskets, in this manner, they cover them with strong grey paper (the strongest paper is the best), and so place their worms upon them. This sort of basket I tried while I resided at Montauban, and found them lighter and more handy than those before described; however, it must be owned, that from their figure they do not pack so easily; or, in other words, take more room upon the shelves of the stage.

But to return to the treatment of the worms upon their being newly hatched: it is proper to observe, that too many leaves should not be given to them at one time, and that the leaves given should be spread very thin; because, if too thick put on, a great number of the worms, as they are then so small, will run the risk of being lost amongst the litter, from which they will not be able to disengage themselves; and you must be careful to cut the leaves small during the first ten or twelve days, where the number of your worms is such as to admit of your doing so: but if your quantity of worms is large, it would require too much work to cut the leaves for them, so that in such case you must give them entire.

When the worms are in their first age you need only clear away the litter once, because their ordure at that time dries as fast as they make it, being in small quantity. When the litter is to be taken away for the first time, you have only to turn the parcel upside down, and so pull off such a quantity of the litter as you find necessary, which is the most expeditious way of cleaning them at that time.

In giving the leaves to the young worms, you must make the leaves lie hollow upon them, to give air to the worms. When put on too flat and close, they prevent that free circulation of the air which is at all times necessary for the health of these insects.

During the whole of the first age, the leaves of the young plants of the mulberry, in the seed bed and nursery, as being the tenderest, are greatly preferable to the leaves of older trees as food for the young worms; for which reason it becomes of importance to have always a succession of young plants coming on yearly in your nursery grounds.

When the silk worms enter upon their sickness, they abstain from that moment from all manner of food. As soon, therefore, as you observe some worms of a parcel begin to grow sick, in place of three give them only two meals a day; when more of them sicken, confine them to one meal only; and from the time you observe most of them sick you must give them no more food, till the whole parcel, or at least the far greatest part of them, get over their sickness, (by having cast off their old skin), that you may carry them all equally on; at least as nearly so as possible, which saves a vast deal of trouble in the management.

When the silk-worm gets over his first age or sickness he is of a greyish colour, and his little trunk, or point of his head, is of a jet black colour, by which he is then distinguished.

When he gets over his second sickness that little trunk is of a brown colour.

When he gets over his third sickness his head is remarkably large, which is the distinguishing mark at that time.

And when he gets over his fourth sickness he is of a brownish yellow, or deep buff colour.

You must not clear away the litter from the worms while they are about changing their skin, or what is called their sickness; but as soon as they have got clear of their old skin then you are to remove all litter.

During the second age it is advisable still to continue to feed your worms with the leaves from the young plants in your nursery, as these are still preferable to those of older trees for the worms at this time.

You must now begin to be attentive to clear away the litter from time to time, so as to prevent all danger of its heating, which proves highly injurious to the worms. These insects are remarkably fond of cleanness, which besides helps to enliven them, and gives them a keen appetite for the first leaves which are given to them always after cleaning. The litter is taken away in the following manner. You scatter some fresh leaves upon one corner of the basket, to which the worms having attached themselves, which they will readily do, you then take up the worms by means of the leaves and stalks they cling to, leaving the litter underneath. Having thus taken up all the worms from that corner, and placed them above those adjoining to them, you then clear away the litter from that corner, and carefully sweep together, with a little broom of twigs or heath, all the refuse and excrement, which you must remove entirely before you replace the worms in their station; and in the same manner you must proceed with the rest, till you have thoroughly cleaned the whole basket.

During the third age make use of the leaves of such trees as have been planted out in the field, but reserve the leaves of your oldest trees for the fourth age, as these last leaves are reckoned the best for the worms when come to their maturity.

Be attentive to cleaning away the litter as before directed, which, during the third age, should be done at least four or five times; and take care to clear away, from time time, all dead worms the moment you observe them: and to throw aside also regularly all such worms as appear to be diseased, to prevent them from infecting the rest, which will happen if this article is not pursued with the strictest attention. All the worms which you observe to grow of a yellow colour, and to have their skin shining, are strongly diseased, and must be immediately thrown away, for fear of infecting the sound ones. These diseased worms sometimes void a yellow liquid at the tail, and it often also bursts out at other places of their bodies. These must always be attentively removed the moment they are observed; but it becomes more essentially necessary before the worms enter into their third sickness, because at this time they become most dangerous, by voiding the yellow liquid above mentioned, which is poisonous to the worms, and exceedingly contagious; insomuch, that every worm that happens to touch this liquid is sure to be infected with the same distemper, which has hitherto been found to be incurable.

Here I must observe, that tobacco is an immediate and mortal poison to the silk-worm. If a few grains of snuff shall happen to fall upon one of these insects, it immediately shows great signs of agitation and distress, and in about a minute's time it is thrown by it into convulsions, which end in death. Just before expiring it throws out a small glob of watery substance from its mouth; and if any other worm happens to touch this watery glob, that worm will also be immediately attacked with convulsions and die. Hence it appears to be necessary, that persons who are employed in feeding the silk-worms should either give up entirely at that time the use of snuff, or should at least be extremely careful not to suffer the smallest grain of it to fall upon the silk-worms, as their death is the certain consequence of their touching it; besides the danger arising to the other worms, from their touching the little glob of watery substance emitted by the worm first infected before it expires. It is proper also it should be known, that oil of any kind is as immediate and dangerous a poison to the silk-worm as tobacco itself.

It has been remarked, that it is improper to change the worms during their sickness, because it may occasion the loss of some of them. But it is necessary to add, that if the litter at that time should prove to be in such quantity as evidently to run the risk of heating, before the worms can get quit of their old skins, which they generally do not accomplish in less time than two days and a half, that it is better to suffer the loss of a few worms, by removing the litter at that time, than to run the risk of losing the whole parcel, which undoubtedly would happen if the litter should be heated before the operation is over of their changing ther skinis. This article of keeping the worms clean will appear to be of high importance in the silk culture, when it is added that it is commonly computed that the loss sustained yearly in France, by the death of the worms during the times of their four different sicknesses, by being smothered in the litter, by the great quantity of litter, leaves, and worms above them, and by the litter's happening to grow damp and to heat at these critical periods, is not less, upon an average, than between two and three millions of livres annually, which is equal almost to a tenth part of the whole yearly produce of silk in France, which, as already mentioned, is computed at thirty millions of livres.

Here I must remark, that this is the time to assort your worms into different classes, and endeavour to have every class as nearly of a size as possible; that each class may be wholly ready to mount, and make their cocoons at the same time. This is also the time to push on those worms which appear to be a little behind, by not having had an equally easy access to the leaves with the rest, that you may render them equally ready to mount with the others. This is done by putting them into a basket, apart by themselves, and by giving them an additional meal each day more than what you give to the others, until you observe by your eye, that they appear to be equal in point of size with the rest.

Being now arrived at the fourth age, the time approaches when the worms will mount in order to form their cocoons; and the person, therefore, who pursues the culture of silk, must now begin to prepare for that important period. One of the first objects of his attention must be to provide himself with a sufficient quantity of small brush-wood, for making the cabins of the worms; and there is nothing more proper for this purpose than heath or broom, when either of these can be obtained; when neither heath or broom are to be had, any other kind of small brush-wood will answer, preferring always such as is bushy at the top, and whose twigs are of a sufficient strength to support the weight of the worms. But it is to be remembered that the slender brush-wood is the best, that you may be able to bend it which way you will. Strong brush-wood is not so pliable, and by that means not proper for the purpose.

Having provided your brush-wood, it may be proper to prepare a parcel of baskets, for such of your worms as are soonest ready for mounting, in the manner practised at Montauban, in Quercy, which is done as follows: you take a round willow basket, which you dress with brush-wood, putting the wood round two-thirds of the basket, and leaving the other third open for putting in the worms, and to give an opportunity to clean away their litter. You then pull the ends of the wood together at the top, so as not to press too closely upon each other, and so tie them with a little twine, or pack-thread, to keep them in their place; after which you put a paper cap, pretty large, upon the top of the wood, it having been found that the worms are fond of making their cocoons under a cover of this kind, as it affords an opportunity of attaching some threads of silk to the paper, which enables them to fix their cocoons the more firmly in their place. I had some baskets dressed in the above manner, the brush-wood of which rose near four feet above the basket. This appeared to me to be an excellent contrivance, as it had the advantage of keeping the worms much more cool and airy, than when in the cabins on the stage. But this cannot be done with a large quantity of worms, because it occasions a good deal more expense; besides, that these baskets take up a great deal more room than the cabins on the stage.

In putting up the cabins on the stage, the two rows of brush-wood at the extremities of the stage are made much thicker than the others, especially for six or eight inches above the shelf, to prevent the worms from getting out at the ends, and falling over the stage. In putting up the other rows, you lay a little piece of wood, or a reed, across the stage, for each row; and in putting up the brush-wood, you make the first turn to the right hand, and the second to the left; and so alternately, keeping the reed in the middle, which binds all fast. This article of the reed I first saw practised at Montauban, and seems an improvement to their manner of erecting their cabins in Languedoc, as it serves to make the cabins firm, and to keep the rows straight.

In dressing the stage with the brush-wood, it is advisable to cover the pillars which support it, and to cover likewise the top of the stage with brush-wood. In constructing the cabins, great care must be taken to put up the brush-wood in such a manner as to allow a passage for the worms betwixt the different branches, which, however, must not be too wide; and it is right to make a great number of the points of the brush-wood touch the shelf; because it affords the greater opportunity to the worms to mount. Many people at Montauban, I observed, put a number of roses, or other sweet smelling flowers, upon the pillars which support the stage, and in other parts of the room, with a view to sweeten the air. But the best apparent means for this purpose is to take care to keep up a free circulation of fresh air in the room, by keeping open all the windows, and the doors also, if you find that be necessary.

(*To be continued.*)

Notice of a New Work on the Silk Manufacture.

Mr. Badnall, of Ashenhurst Hall, near Leek, whose first patent for improvements in silk throwing was published by us in our fourth volume, page 289, and who has since taken out two more patents for farther improvements thereon, is now preparing for publication an extensive treatise on the progress of the silk manufacture, from its earliest rise to its present state of perfection, accompanied with drawings and descriptions of the various machines used in this and other countries, and embracing the latest improvements, made in this important branch of manufacture.

We have seen some of the drawings intended for the work, which were made by a Sicilian artist; and, if we may judge from them, and from the great experience of Mr. Badnall in this manufacture, we have little hesitatian in saying, that the forthcoming work will prove of great national importance.

LIST OF PATENTS FOR NEW INVENTIONS,
Which have passed the Great Seal since Feb. 25, 1826.

To James Fraser, of Houndsditch, in the city of London, engineer; for an improved method of constructing Capstans and Windlasses. Dated Feb. 25, 1826.—In two months.

To Benjamin Newmarch, of Cheltenham, in the county of Gloucester, gentleman; for certain inventions, to preserve Vessels and other bodies from the dangerous effects of external or internal violence, on land or water; and other improvements connected with the same. Dated Feb. 25, 1826.—In six months.

To Benjamin Newmarch, of Cheltenham, in the county of Gloucester, gentleman; for a preparation, to be used either in solution or otherwise, for preventing decay in Timber or other substances, arising from dry-rot or other causes. Dated Feb. 25, 1826.—In six months.

To James Fraser, of Houndsditch, in the city of London, engineer; for a new and improved method of distilling and rectifying Spirits and strong Waters. Dated March 4, 1826.—In two months.

To Robert Midgley, of Horsforth, near Leeds, in the county of York, gentleman; for a method, machinery, or apparatus, for conveying persons and goods over or across rivers or other waters, and over valleys or other places. Dated March 4, 1826. —In six months.

To George Anderton, of Cleckheaton, in the county of York, worsted-spinner; for certain improvements in the combing or dressing Wool and waste Silk. Dated March 4, 1826.—In two months.

To James Neville, of New-walk, Shad Thames, in the county of Surrey, engineer; for a new and improved Boiler or apparatus for generating Steam, with less expenditure of fuel. Dated March 14, 1826.—In six months.

To Nicholas Hegesippe Manicler, of No. 102, Great Guildford-street, Southwark, in the county of Surrey, chemist; for a new preparation of Fatty Substances, and the application thereof to the purpose of affording light. Dated March 20, 1826.—In six months.

THE TECHNICAL REPOSITORY.

XXXVII.—*On an excellent portable, botanical, and table Microscope, made expressly for the Editor, by the late scientific Mr.* SAMUEL VARLEY.

WITH PLATES.

IN plate IX. we have given a view of this valuable instrument of its real size, and as mounted for the table.

The stem, or pillow of this microscope, A, is of a triangular shape, and is made hollow: it takes asunder at the part marked B, so that the upper part of it only, with the improved forceps, C, the head, D, carrying a wheel with five magnifying lenses, and the circular plate and block, E, at the bottom of the stem, which is to be placed in the end, B, of the stem, to serve to hold it more firmly in the hand, are all the parts forming the portable or botanical part of the microscope; these are contained in a neat box for the pocket, four inches long, one and a half inches wide, and one inch deep, internally; so that it is exceedingly portable, and forms a most pleasing and highly useful instrument in the fields, for the use of the botanist particularly, as *the improved forceps* are capable of assuming and retaining a great variety of positions, by the use of the extra arm F; and when the object is fixed in any desired situation, it may be viewed by any of the five lenses in the wheel, and accurately adjusted by means of a pinion with a milled head, G, acting in the rack, H, on the stem, A.

When used as a table microscope, and as shown in the plate, the block, E, being taken out of the upper part of the stem, both parts of the stem are fitted together at B; and upon the lower part of it, the illuminator, I, is to be placed, and the block, E, being inserted into the lower part of the stem, a dove-tailed plate, J, underneath it, is to be fitted into a dove-tailed groove, made in a square plate, K, which is let into the top of the larger box or case, L, and is secured by screws, and thus firmly supports the instrument for use.

Having thus briefly mentioned the modes by which this instrument is converted from a portable one, into a fixed one, for the table, or *vice-versa*, we shall proceed to furnish our readers with a more particular detail of the construction of the various parts already mentioned, as well as of other additional and valuable parts, not yet alluded to.

And, first, of the construction of the triangular stem, A; the manner of fitting it together, and of introducing the different parts within it, and which indeed constitute one of the chief improvements which this instrument possesses over other microscopes.

We have already described, this stem, (which, as well as most of the other parts, is formed of brass), as being triangular and hollow; it is indeed equi-angular, and is made accurately, both inside and outside, by being drawn upon and through *triblets,* in the manner of making the cylindrical draw-tubes for telescopes.

From this form of the stem *great strength and lightness* are derived, and it equally admits of receiving parts within it, and of having other parts to slide upon its exterior surfaces, with great advantage.

From the nature of the triangle, we have it always in our power to preserve a perfect contact with all its three sides; this property Mr. Varley has most ingeniously availed himself of, by employing triangular metal blocks, fitted to the interior of the stem, and one side of each of which is made to spring outwardly, and, acting against one of the interior surfaces of the stem, thus forces the other two sides of the blocks into close contact with the other two interior surfaces. This will readily be understood, by referring to figs. 1 and 2, of plate X. where M represents a triangular block of brass, inserted into the top of the lengthening, or lower part of the stem, A, and secured with soft solder. N a slit, sawn down parallel with and near to one of its faces, partly through the block, and thus leaving the part O at liberty, when bent a little open, to act as a spring in the manner just described, when the end of the upper part of the stem is slipped upon and over it. Fig. 2 is a plan of these parts. Similar springing triangular blocks are also affixed to the wheel of lenses, D, and to the circular plate, E, as indicated by the dotted lines in plate IX., and fitting into the upper and lower parts of the stem, A, in the manner described, the whole become fixed steadily together, and can be as readily taken asunder again.

The additional arm, F, of the forceps, is of such great utility, that it well deserves to be applied to other microscopes, from the facility which it affords in placing the objects held in the forceps in every variety of position for viewing them. It is well known, that the common forceps have merely a round stem affixed to the joint, which fits into a hole made in the sliding stage to receive it, and hence their range of motion is exceedingly confined. Whereas, in this, we can place the forceps in a vertical, oblique, horizontal, or any other required position, at pleasure, so as to view the objects to the greatest advantage. This arm, F, is formed of two similar parts, united together at each end by means of screws, as shown in fig. 3, of plate X. Cylindrical holes, made through these cleft parts, fit upon cylindrical necks with shoulders, one of which is made upon the stem of the joint of the forceps, and the other upon a stud affixed to a plate, which can be united with the sliding carriage on the stem of the microscope. Fig. 4 represents the arm F, as applied upon the stem of the forceps P, and the stud Q, of the plate; and fig. 5 shows the cylindrical neck of the latter; R R are the binding screws. This construction is abundantly simple, and of its utility we can speak from long experience.

The manner of affixing the forceps to the sliding carriage, so as to admit of their being easily removed, and a stage for sliders &c., substituted in place of them, is also peculiar. Fig. 6, of plate X. is a front view of a plate, S, affixed to the forceps, and which is shown edgeways in fig. 4. Upon the root of the stem, Q, a turning arm, T, is affixed by means of a collet, and a pin passed through the stem, having a circular part, U, upon it, which can be made to enter into a gap, made in a stud, V, upon the front of the sliding carriage of the stem, (this is shown seperately in fig. 7), and thus prevents the plate, S, from quitting the sliding carriage. To ensure its stability, two steady pins, W W, at the back of the plate, S, (see fig. 4), are made to enter two holes, provided in the sliding carriage to receive them. The forceps may, of course, be again disengaged from the sliding carriage, by withdrawing the arm, T, from the gap, V, in the stud. The stage is also fitted up with similar provisions of an arm and steady pins, to secure it to the sliding carriage.

The triangular socket of the sliding carriage is provided with an internal spring, to steady its motion upon the stem; and the axis of the pinion turns in half-holes in the usual manner, secured to the socket by screws. The rack is cut on the angular back of the stem, and contains twenty-five teeth in an inch, so that it is a tolerably fine one, in order to secure a nicer adjustment of the object.

The wheel, with its five lenses, (figs. 8 and 9), turns upon a cylindrical stud, affixed on the underside of the head, D, and is prevented from coming off, by means of a semicircular spring, X, screwed to the head. The rim of the wheel is made conical, the wider part of the cone being next to the head; and the spring has two bevelled parts at its ends, the one being formed with double inclined planes meeting at an angle, to enter into any one of ten gaps made around the wheel, at equal intervals, so as to fix either of the five lenses in its due position with regard to the central hole in the head, or to bring a blank space opposite thereto; the other end of the spring has merely a flat oblique part made upon it, to lodge upon the conical rim of the wheel, and, as before said, helps to prevent it from coming off the central stud on which it turns. The notches in the wheel are placed within easy reach of the finger nail, so as to turn the wheel round readily thereby.

Four of the lenses in the wheel, viz. those of one inch, six tenths, five tenths, and three tenths of an inch, focii, are unequally sided, being formed of radii in the proportion of six to one, the flatter side being placed next to the eye of the observer. These lenses are peculiarly adapted for a single microscope, on account of the extent of their field of view. The fifth lense in the wheel, of a tenth of an inch focus, is equal sided; as are likewise three others, which are mounted in seperate heads, the sixth being the twentieth of an inch; the seventh, the thirtieth of an inch; and the eight, the *sixtieth* of an inch focii; the three last in seperate heads, as above mentioned, being mounted in such a manner as *to permit the eye of the observer to apply itself close to the lens, and to present as small an obstacle as possible between the lens and the object to be viewed by it.* These desirable properties are obtained in the following manner. Fig. 10 is a view of the head, containing the lens of the twentieth of an inch focus, the other two being similar to it. This head is turned into the shape of a thin-convex and concave spherical plate, shown in a line of section at fig. 11, surrounded with a thicker rim or border. This convex plate projects beyond the head, as shown in fig. 12. A proper cavity to fit and receive the lens, and a small aperture likewise, is made in this plate; and similar ones also in a slender bar of polished latten brass, which is stretched across the face of the convex plate, and is secured at each end by means of screws, which pass through it, and enter into screwed holes, made in the rim or border, around the head; the lens being thus screwed between the plate and bar, and bound firmly in its place by the two screws. The eye can thus enter the concavity made in the plate, and place itself as close to the lens as possible, an object of great consequence in using these minute lenses; whilst there is merely the slip of thin latten brass interposed between the opposite side of the lens and the object to be viewed by it. *The lens of only the sixtieth part of an inch focus is in this manner rendered an exceedingly useful and manageable one!* Mr. Varley had also even perfected a lens of *the one hundredth part of an inch focus only*; but he never mounted it, although he thought it was quite possible to do so, in the above manner.

The illuminator of this microscope, I, plate IX. being fitted up in a peculiar manner, to adapt it to the triangular stem, requires also to be described. In plate X. fig. 13 is a side view of the illuminator, I; Y, its frame, and Z, the semicircular screen, made as usual. The stem of the illuminator, *a*, has a neck or pivot *b*, (see fig. 14), which passes through a pivot-hole made to receive it in a piece of brass *c*, which is bent twice at proper angles behind it, to fit and slide upon the triangular stem of the microscope, as shown at *b* in plate IX., and at *b b*, in fig. 15; and it thus serves as a spring, which clasps, and remains steady upon any part of the stem. The stem of the illuminator, *a*, has likewise a circular plate upon it, *d*, shown in figs. 14 and 16, upon which a cleft spring, *e*, figs. 13 and 16, secured to the bent piece, *c*, by a screw, *f*, and a steady pin, *g*, presses, and thus keeps the stem of the illuminator frame in its place in the piece *c*, and affords sufficient friction to cause it to remain stationary in any position required. Two ears, *h h*, project on each side from the top of the spring, *e*, which serve as handles to move the illuminator by, to its required height upon the stem of the instrument.

(*To be continued.*)

XXXVIII.—*Observations on the Culture of Silk. By the late* ARCHIBALD STEPHENSON, *Esq. of Mongreenan, in Ayrshire.*

(*Continued from page 258.*)

IN forming the arches of the little cabins with the brush-wood, there is always a little opening at the top of each pillar, occasioned by the curve or top of the circle. Take care to make this opening pretty wide, because it has been observed, that the worms make choice of that opening, by preference, to fix themselves in making of their cocoons. In order to make this opening of the width it ought to be, the brush-wood should not be altogether straight, but rather crooked or bending. These openings are not only evidently the choice of the worms; but another advantage also arises from them, namely, that your cabins by this means contain a greater number of worms than it is possible for them to do when these openings are too small; and consequently fewer cabins will answer your purpose. When the brush-wood is quite straight, it must necessarily occasion these openings to be made. The brush-wood ought to be quite stripped of its leaves, and perfectly dry.

If, in forming the cabins, you place the brush-wood quite upright, the worms, when mounting, run a great risk of tumbling down, of which I have seen several examples; and those worms which tumble down are for the most part destroyed by the fall. In order to avoid this inconvenience, you must make the brush-wood which forms the sides of the arch slope a little, by which means you secure much firmer footing to the worms in mounting. Besides, when you form the cabins, you must be at pains to cut off all the very small slender shoots, which, when left to themselves, and not properly bound in with one another, have not strength sufficient to carry the weight of one worm, far less of several; and which, if left, must for that reason always occasion the loss of a good many worms by their tumbling down, as above mentioned.

In describing the stage, it was said to be proper to make the lowest shelf six inches broader than the one above it, that the lowest may project three inches on each side further than the one immediately over it; and to make the same difference of breadth in all the other shelves progressively as you go up to the top of the stage, which three inches of breadth in the different shelves is intended to receive the worms which may happen to fall from the shelf above. And therefore these different projections must be covered with brush-wood, when once your cabins are well furnished with worms, as this will help to break the fall of such worms as may happen to tumble down. And for the same reason it is advisable, when once your cabins are well furnished with worms, to put a little brushwood in the bottom, and at the entrance of each cabin, as it will be of service to such worms as fall from the brushwood above, and afford them a proper convenience for making their cocoons in case they should be so stunned with the fall as to disable them from mounting again on the branches.

But to return to the treatment of the worms during the fourth age: as soon as you find several of your worms have got over their fourth sickness, you must pick them ont and put them by themselves, that is, all those that get over that disease for the first two days may be put into one parcel; those of the next two days into another parcel, and so on with the rest, that each separate parcel may be carried on as equally as possible.

Here I must observe, that the practice in France is to give none of the tender leaves, from this time forward, to the worms, but let the whole of their food consist of the leaves of the oldest trees they have, which, they think has the effect to give more consistence and strength to the silk produced by them; and it is proper to add, that from getting over the fourth disease, till within four or five days of their mounting, they are in use to give four meals a day to their worms.

The most attentive care must also be given to clear away the litter regularly every day, and if it can be got done, it would be advisable to clear away the litter twice in the twenty-four hours, especially during the four or five days immediately before mounting. If this cannot be done, as it is often found to be difficult to get it accomplished when the quantity of worms is large, you must, however, constantly make it a rule to clear away the litter regularly in such a manner as to prevent it at any time from increasing so much in quantity as to make it run the smallest risk of growing damp, and heating, which never fails to destroy the worms.

Many people during the four or five days which precede mounting, which the French call the *grande fraize*, are in the custom of giving from four to five meals a day to the worms, giving a large quantity of leaves at each meal. But it seems much more advisable to give them fewer leaves at a time, and to repeat their meals oftener, even to the number of eight or nine times in the twenty-four hours, according as you find them in appetite; by which means the leaves are more quickly and thoroughly eat up, without occasioning so great an increase of the litter. But what is still of more consequence, the fresh leaves so often repeated never fail to give a fresh edge to their appetite; so that in fact, in the space of twenty-four hours, the worms actually eat up a much larger quantity of leaves than they could have done by following the other practice of four or five meals a day, as none of the fresh leaves are spoiled by their treading upon them. This practice of course hastens the worms to their full maturity, and upon the whole saves a considerable quantity of leaves, because few or none of them are lost amongst the litter. Besides, that the operation is by this means sooner brought to a conclusion, and the worms always kept in high health and appetite by it. Upon these occasions let it be a fixed rule to feed them at night, immediately before going to bed, and as early as you possibly can in the morning.

There is another particular to which it is proper to pay attention, and that is, that the moment a basket of worms is cleared from the litter, the litter should be instantly carried out of the room, and along with it all the dead worms you can find, in order to prevent, as far as you can, any bad smell from taking place in the room, which is always hurtful to the worms, nothing conducing more to their health than cleanness, and preserving always good air in the room.

During the four or five days which precede the mounting, the worms eat with the most voracious appetite, and in that period consume an incredible quantity of leaves, so that the supplying them with fresh leaves, and the clearing away of the litter, become at this time a most laborious, incessant, and fatiguing work for those who attend them.

You will know when the worms are ripe, by observing them with attention when you give them fresh leaves. Those that are ripe, instead of eating, avoid the fresh leaves, and run over them as fast as they can; and you will observe them wandering about on the sides or rim of the basket. You will also know it by looking at them on the side opposite to the light, as you will then find them to be transparent like a new laid egg, and of the colour of the silk, which is also much the same with that of a new laid egg. When they are nearly ripe their bellies begin to grow transparent first of all, but they are never thoroughly ripe till their heads are transparent also.

You must not be too hasty in putting up the brush-wood on the baskets on the stage for the worms to mount. This ought not to be done till you observe a good many of your worms offering to mount, because the brush-wood keeps the worms too close and warm, and exposes them to the danger of that disorder, which the French call the *touff*, which is very fatal to the worms, and which does not seize them till they are just ready to mount. When they are perfectly full, and ready to mount, they are rendered feeble by too great heat, and the silk fairly choaks them, so that a great deal of fresh air becomes more particularly necessary for them at this time than at any other. For this reason it is even thought to be advisable not to put up your brush-wood until you have seen a cocoon fairly made upon the stage. At any rate you can have some of your large baskets (of which you should have an ample provision) ready dressed with brush-wood, into which you can from time to time, as you observe them, put such of your worms as you find are fully ripe for mounting. Besides, when you see a whole parcel ready to mount, you have only to take the basket which contains them out of its place, and put up one of those which is already dressed with the brush-wood, by which means you can put your worms directly into the little cabins prepared for them, which will render your work much easier than it would be otherwise, and make it less hurrying. The basket thus emptied of the worms should be instantly dressed with brush-wood, to be in readiness for the next parcel that shall be ready for mounting. Not a minute is to be lost when the worms are fully ripe, so that a number of these additional prepared baskets are of the utmost consequence at this time.

In preparing the little cabins for the worms you must make choice of such small brush-wood as is bushy at the tops, as already mentioned; and in arranging them you must intermix the tops of them with each other, which will render them thicker in the heads, but taking care always to leave little openings betwixt the twigs, so as the passage for the worms may not be stopped, which is attended with this advantage, that it affords a great many little places proper for the worms to form their cocoons in. When the heads of the brush-wood are too thin, the worms find themselves at a loss to fix themselves, and spend a great deal of their strength in ranging from branch to branch, to find a proper place for them. In placing your brush-wood, you must order it so that the bottom parts of it shall stand as close to one another as possible, that the worms in groping about may everywhere find bushes to cling to. In using many kinds of brush-wood, where the tops are very bushy, this will of course put the bottoms at a distance from each other. But these vacancies you must fill up with little twigs, for the purpose above mentioned; to wit, that the worms may everywhere find branches to crawl on.

When you put up the brush-wood betwixt two baskets, that is, when there is one basket placed over the head of another, as is always the case on the stage, you have only to cut the branches of an equal length with one another, but about eight or nine inches longer than the distance betwixt the two baskets; then resting the bottom part upon the undermost, you bend the top in a curve downwards, either entirely to one side or to both, as the bushyness of the brush-wood will allow of it. The ranges are made across the breadth of the basket, at the distance of about eighteen or twenty inches from each other, so that you may easily put in your hand from one side to the other, to enable you to clean the intervals from time to time from the litter, as you shall find it necessary, which ought to be done at least once in twenty-four hours after the bushes are put up, and even twice if you can find time for it. The bushes are placed in such manner as to form with their heads little arches betwixt each row of the branches. By placing the bushes as above they stand erect and firm, because they press equally upon the undermost as well as on the upper basket.

When the worms are mounted on the brush-wood, care must be taken not to suffer anybody to disturb them by handling or touching the brush-wood, because when they begin to work, their first operation is to fix so many threads of silk to different parts of the branches, which threads are to serve to support and hold up their cocoons in their proper poise. If any one of these silk threads is broke by handling the branches, the worm finds, when he comes to work in the cocoon, that by the loss of that thread the cocoon has lost its poise, by which means, as it does not remain steady, he cannot work with advantage, so as to finish his cocoon properly. Disappointed by this means of continuing his work, he pierces the cocoon, quits it altogether, and throws out his silk at random wherever he goes, by which means his silk is wholly lost, as is the worm also, as he finds no place to lodge in with propriety, in order to prepare for his last change of state when he is to come out a butterfly.

Some of the threads of silk, which it has been already said the worm attaches to the different branches, upon his first beginning to work, are likewise sometimes broke by another worm working in his neighbourhood, which is attended with the fatal consequences above mentioned, though this last is an accident which happens but very seldom.

Such of your worms as you find loiter below, without mounting, notwithstanding they are ripe, you must be careful from time to time to place upon the brush-wood, which is ranged at the two ends and along the sides of the stage. There are always some of the worms which are lazy, or have not strength enough to mount on the branches, which however are strong enough to make good cocoons when they are placed where they can make them, without the fatigue of mounting the brush-wood. Those which are so unlucky as to tumble from the brush-wood should also be placed with the other weak worms, because the fall generally diminishes their strength greatly; and those which you then place upon the brush-wood should be covered over with a piece of paper, to which they attach the threads of silk to keep their cocoons steady. You may also place some of the weak worms in papers, made up in the form of a cone or sugar loaf, in which they will make their cocoons extremely well.

Great attention must also be paid to visit carefully from time to time all the different cabins, in order to remove immediately all diseased and dead worms; because the last, if left, will presently stink, and occasion a bad smell in the room, which would particularly annoy the worms which are at work in making their cocoons in the same cabin; and the diseased ones would infect the others which are sound.

When it is observed that a great proportion of the worms of the same basket are ripe, and that they are wandering about in quest of the brush-wood, the common practice has been to place the whole worms of that basket at once into the cabins for mounting. But this practice is attended with no small degree of inconvenience and danger, because it is impossible to manage your worms in such a manner, that the contents of a whole basket shall all of them be ready to mount at the same instant. The consequence then is, that those which are ripe mount directly, and those which are not ripe remain in the cabins, and must have food given to them till such time as they are ready to mount in their turns, during which time the litter must be changed frequently to prevent corruption: but what is worst of all, the worms which are mounted on the brush-wood, before beginning to shut themselves up entirely in their cocoons, discharge a quantity of liquid matter, which falls upon the worms below in the cabins, and wets and dirties them prodigiously; and that glutinous liquor drying and hardening upon their skins, prevents their perspiration, and deprives them of that pliancy and agility which are so requisite to enable them to mount, as well as to make their cocoons. The consequence often is, that the worms thus wet with that glutinous liquor contract diseases and die, at the very instant they are ready to mount; and as these diseases are too often contagious, by the worms bursting, the contagion is spread over the rest, which become also infected, and so the whole which remained in the cabins are often entirely lost.

Some few people, who are more attentive, and are sensible of the dangerous consequences of the above method, follow a different practice. They have the patience to pick out the worms, one by one, from time to time, as they observe them to be ripe, which they then place in the cabins, and which never fail to mount immediately, when they are properly chosen; that is, when the person who gathers them is a proper judge of their real point of maturity, which discovers itself by their bodies, but more particularly their heads being perfectly transparent, as before mentioned. The other worms, which are not ripe, they leave in the basket, and give them their food in the usual manner, till they become ripe in their turns, when they are constantly gathered up from time to time, and put into the cabins as they come to maturity. By this means you can change them with ease, and they are safe against being wet with that glutinous liquor above mentioned, which from repeated experience has been found to have such pernicious and destructive consequences. One may alledge that this last practice occasions an additional trouble, but the answer is obvious, that by this method a great number of worms are preserved, which are utterly lost by following the other practice of putting the worms of a whole basket at once into the cabins; and consequently the quantity of silk produced is considerably increased, which does more than repay that additional trouble tenfold.

In putting the ripe worms into the cabins, take care to place them first of all in the middle of the cabins, that the middle may be well furnished with worms before you place any at the sides. Should you begin first with the sides, or outward ends of the cabins, you will find it extremely difficult to supply the middle of the cabins with worms, without disturbing and even destroying some of those which are mounting on the sides, in reaching in with your hand towards the middle.

I shall here take an opportunity of mentioning, that during the two first ages of the worms my practice always was, agreeable to Mons. Marteloy's system, to keep the windows of the room shut; but when once the second age was over I inured them by degrees to the fresh air, by opening the windows at first for a couple of hours in the middle of the day, and increasing the time of the open windows from day to day, till at last I kept them always open day and night, particularly from the time of their getting over their fourth malady, till they completed their cocoons, unless the weather happened to prove remarkably cold and wet. But though this practice succeeded perfectly well in the south of France, I do not by any means take it upon me to say that it is advisable to pursue the same method in Britain, as the difference of climate is great. On the contrary, I should incline to think, that in England the windows should always be kept shut during the night; but when once the second age is over, that it would be proper to habituate the worms gradually to the fresh air during the day, more particularly after their getting over their fourth malady, when it is of the greatest consequence to them: but even then, in case of cold wet weather, I should think it advisable to shut the windows occasionally during the day. In short, in this article, a man's conduct must be regulated by prudence and good sense, in which his experience will greatly assist him.

Though the following article was regularly entered in my notes, it somehow escaped me at the time I drew out from them the foregoing observations, which makes me take the liberty of adding it here, though out of its place, as it appears to me to merit attention.

Upon the article of hatching the worms, it has been recommended to save the production of the first four days, as I observed this to be the general practice in France; but I must mention, that having met with a French gentleman at Montauban, who I understood had dedicated much of his attention to the culture of silk, and in which I was assured he had been particularly successful, I took the liberty, with a view to gain information, to request of him to favour me with an account of his method of management, with which he politely complied. By the account I received from him, I found that the material difference betwixt this gentleman's management and the general practice consisted in the following particulars. He told me, that having long observed that the worms which were first hatched turned out always to be more healthy and vigorous than those which were later in coming out, he had for this reason adopted the following plan, which he had then followed for several years, and to which, in a great measure, he attributed his success.

If his intention was to raise a quantity of worms equal to two ounces of eggs, his practice was to put two ounces and a half of eggs to germinate, and to save no more than the production of the three first days, throwing away all the rest. He likewise made it a rule, upon their passing through their different maladies, to take only the forward worms, throwing away regularly all those which remain long in getting over their maladies, and he gave the following reason for his continuing to follow this plan; namely, that from many years experience, he said he had found, that those worms which are hatched after the third day always turn out to be weakly, and are tedious in all their operations. For the same reason he rejected all those worms which linger in getting over their maladies, which he said was owing to their weakness, or to their being infected in some measure with some disease, which generally carried them off before they could make their cocoons; or if they did get the length to make their cocoons, these last he maintained were so light, that they were not equal in value to the expense of the leaves which these worms will eat during their *grande fraize*. At getting over their different maladies, he saved only such as came away the first two days, throwing away all that were not ready at the close of the second day. From what observations I had myself made upon the silk-worm, I thought this gentleman had a great deal of reason upon his side; but as, in every thing in relation to this culture, I uniformly made it a rule to satisfy my mind fully by experiment, I firmly resolved to submit his plan to that test. I was, however, disappointed in fulfilling my intention in that respect, by my having been obliged to return to Britain upon business before the next season of the silk culture came round. At the same time, as I still continue to regard this article as a matter of great importance to that culture, I would humbly advise, that it should be fully canvassed by experiment.

III. The cocoons should be allowed to remain upon the brush-wood for six or seven days after the last of the worms of that particular parcel are mounted.

After the cocoons are taken down, they should be assorted according to their colours, setting apart all the weak cocoons, and such as are double. Those of each colour, which have a shine upon their surface, and thence called sattiny, should also be put by themselves, as they form the second sort of silk. The double cocoons form the coarsest silk of the whole.

All the floss, or loose silk which is round the outside of the cocoons, must be carefully taken off, because the better the cocoons are cleared from that outer silk the better they play in the bason, and of course the better the silk will wind off.

In clearing off the floss silk from the cocoons, when taken down from the branches, it is customary to make choice of those which are judged to be the best for seed, which are put aside by themselves, and afterwards from the whole of those to pick out in pairs such as are judged best for the purpose; taking care in this last choice to pick out an equal number of males and females, as far as one can judge of the different sexes by the cocoons. In doing this care must be taken to keep the cocoons of the same days mounting always separate by themselves, that the butterflies may pierce the cocoons at the same time. If the good cocoons taken from the whole are all first mixed together, and from this general heap the cocoons, are afterwards picked out in pairs for breeding, the consequence will be, that there will be set aside the cocoons of worms that have mounted the brush-wood upon different days, which of course will have the effect, that the butterflies will pierce the cocoons unequally; that is, not on the same day, but at times distant from each other; so that there will not be an equal number of males and females produced at the same time, which must occasion the loss of a great many of the butterflies, and consequently the quantity of eggs or seed will fall short of what was intended, which shows the necessity of precision in keeping the cocoons of each day apart.

When you happen to have more females than males, you must employ the males of the preceding day a second time, that you may not lose your supernumerary females. But this is only to be done upon an urgent case of this kind, because it is greatly preferable to cause the males to serve only once, if you can calculate so as to have always an equal number of both sexes for copulation.

The double cocoons are to be distinguished by being much thicker than the others, generally broad, and not quite round.

In taking the cocoons off the brush-wood, pick them off carefully, especially if there are any dead worms amongst them, which presently corrupt; because such of the cocoons as touch these dead worms are spoiled by them, as they contract by that touch glewiness from the dead worms, which hinders the silk from winding off properly from the cocoon. The best manner to know the good from the bad cocoons, is to press them at the two ends with your fingers. If they resist well that pressure, and appear hard and firm betwixt your fingers, the cocoons are certainly good.

Though they appear firm upon pressing their sides with your fingers, they may still not be entirely good; the pressure at the two ends being of all others the best manner of knowing the good ones.

After the cocoons are taken down from the brush-wood, such of them as are intended for seed must, with the utmost care, be cleaned from all the floss or loose silk which is about them, which, if allowed to remain, would greatly hinder the butterfly from getting out of his cell; after which, with a needle and thread, you must thread the cocoons by the middle, like a string of beads. But in doing this you must take care not to hurt the insect in the cocoon with the needle. You are only to pierce just as much of the skin of the cocoon as is sufficient to attach it to the thread, and this is done at the middle of the cocoon, to leave the two ends of it free, as you cannot be certain at which of the ends the insect will pierce the cocoon. This being done, you hang up the cocoons against the wall of the room by a nail, until such time as the butterflies come out.

At putting the cocoons upon the thread, in order to prepare them for breeding, be at the pains to place a male and female cocoon alternately upon the thread, that they may be near each other for copulation, when they come to pierce the cocoons; and when the butterflies come out you place them upon a piece of clean woollen cloth, that is perfectly smooth, having no nap or pile upon it, which may be hung upon the back of a chair.

The male is easily to be distinguished from the female, by his body being more slender, and by fluttering his wings oftener, and with a great deal more force than the female. When they have been about ten hours in copulation, the male is to be gently removed, as the female is supposed by that time to be sufficiently impregnated. The female will then proceed to lay her eggs upon the cloth, to which they will closely adhere, and upon which you let the eggs remain till about a month before the usual time for hatching, when they are to be taken from the cloth, which is generally done by means of a thin piece of copper coin, which in France passes for a penny (*un sol marque*), and which is found perfectly to answer the purpose. The cloth upon management, with which he politely complied. By the account I received from him, I found that the material difference betwixt this gentleman's management and the general practice consisted in the following particulars. He told me, that having long observed that the worms which were first hatched turned out always to be more healthy and vigorous than those which were later in coming out, he had for this reason adopted the following plan, which he had then followed for several years, and to which, in a great measure, he attributed his success.

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Besides this power of transpiration, the leaves of vegetables exercise also an absorbent function, which must be no less disarranged by any deficiency of moisture. Some plants derive the greatest portion of their nutriment from the vaporous atmosphere, and are all more or less dependent upon the same source. The *nepenthes distillatoria* lays up a store of water in the cup formed at the end of its leaves, which is probably secreted from the air, and applied to the exigencies of the plant when exposed to drought; and the quantity, which is known to vary in the hot-house, is no doubt connected with the state of moisture of the atmosphere.

These considerations must be sufficient, I imagine, to place in a strong light the necessity of a strict attention to the atmosphere of vapours in our artificial climates, and to enforce as absolute an imitation as possible of the example of nature. The means of effecting this is the next object of our enquiry.

Tropical plants require to be watered at the root with great caution, and it is impossible that a sufficient supply of vapour can be kept up from this source alone. There can, however, be no difficulty in keeping the floor of the house, and the flues, constantly wet; and an atmosphere of great elasticity may thus be maintained, in a way perfectly analagous to the natural process. Where steam is employed as the means of communicating heat, an occasional injection of it into the air may also be had recourse to: but this method would require much attention on the part of the superintendant, whereas, the first cannot easily be carried to excess.

It is true, that damp air or floating moisture, of long continuance, would also be detrimental to the health of the plants, for it is absolutely necessary that the process of transpiration should proceed; but there is no danger that the high temperature of the hot-house should ever attain the point of saturation by spontaneous evaporation. The temperature of the external air will always keep down the force of the vapour; for, as in the natural atmosphere, the dew-point at the surface of the earth is regulated by the cold of the upper regions; so, in a house, the point of deposition is governed by the temperature of the glass with which it is in contact. In a well ventilated hot-house, by watering the floor in summer, we may bring the dew-point within four or five degrees of the temperature of the air, and the glass will be perfectly free from moisture: by closing the ventilator, we shall probably raise the heat 10° or 15°, but the degree of saturation will remain nearly the same, and a copious dew will quickly form upon the glass, and will shortly run down in streams. A process of distillation is thus established, which prevents the vapour from attaining the full elasticity of the temperature.

This action is beneficial within certain limits, and at particular seasons of the year; but when the external air is very cold, or radiation proceeds very rapidly: it may become excessive and prejudicial. It is a well known fact, but one which I believe has never yet been properly explained, that by attempting to keep up in a hot house the same degree of heat at night as during the day, the plants become scorched; from what has been premised, it will be evident that this is owing to the low temperature of the glass, and the consequent low dew-point in the house, which occasions a degree of dryness, which quickly exhausts the juices.

Much of this evil might be prevented, by such simple and cheap means as an external covering of mats or canvass.

The heat of the glass of a hot-house at night cannot exceed the mean of the external and internal air; and taking these at 80° and 40°, 20° of dryness are kept up in the interior, or a degree of saturation not exceeding 528. To this, in a clear night, we may add at least 6° for the effects of radiation, to which the glass is particularly exposed, which would reduce the saturation to 434°; and this a degree of drought which would be nearly destructive. It will be allowed, that the case which I have selected, is by no means extreme, and it is one which is liable to occur even in the summer months. Now, by an external covering of mats, &c. the effects of radiation would be at once annihilated, and a thin stratum of air would be kept in contact with the glass, which would become warmed, and consequently tend to prevent the dissipation of the heat. But no means would of course be so effective as double glass, including a stratum of air. Indeed, such a precaution in winter seems almost essential to any great degree of perfection in this branch of horticulture. When it is considered that a temperature at night of 20° is no very unfrequent occurrence in this country, the saturation of the air may on such occasions fall to 120°, and such an evil can only, at present, be guarded against by diminishing the interior heat in proportion; but whether we run upon Scylla or Charybdis is no very desirable choice.

By materially lowering the temperature, we communicate a check, which is totally inconsistent with the welfare of tropical vegetation. The chill which is instantaneously communicated to the glass by a fall of rain and snow, and the consequent evaporation from its surface, must also precipitate the internal vapour, and dry the included air to a very considerable amount, and the effect should be closely watched. I do not conceive that the diminution of light, which would be occasioned by the double panes, would be sufficient to occasion any serious objection to the plan. The difference would not probably amount to as much as that between hot-houses with wooden rafters and lights, and those constructed with curvilinear iron bars, two of which have been erected in the garden of the Horticultural Society. It might also possibly occasion a greater expansion of the foliage; for it is known that in houses with a northern aspect the leaves grow to a much larger size than in houses which front the south. Nature thus makes an effort to counteract the deficiency of light, by increasing the surface upon which it is destined to act.

The present method of ventilating hot-houses is also objectionable, upon the same principles which I have been endeavouring to explain. A communication is at once opened with the external air, while the hot and vaporous atmosphere is allowed to escape at the roof; the consequence is, that the dry air rushes in with considerable velocity, and becoming heated in its course, rapidly abstracts the moitsure from the pots and foliage. This is the more dangerous, in as much as it acts with a rapidity, proportioned in a very high degree to its motion. I would suggest it, as a matter of easy experiment, whether great benefit might not arise from warming the air to a certain extent, and making it traverse a wet surface before it is allowed to enter the house.

There is one practice universally adopted by gardeners, which is confirmatory of these theoretical speculations; namely, *that of planting tender cuttings in a hot-bed, and covering them with a double glass. Experience has shown, that many kinds will not succeed, under any other treatment.* The end of this is, obviously, to preserve a saturated atmosphere; and it affords a parallel case to that of Dr. Wells, of the anticipation of theory by practice.

The effect of keeping the floor of the hot-house continually wet has been already tried at the Society's garden, at my suggestion; and it has been found, that the plants have grown with unprecedented vigour; indeed, their luxuriance must strike the most superficial observer.

To the human feelings, the impression of an atmosphere so saturated with moisture is very different from one heated to the same degree without this precaution; and any one coming out of a house heated in the common way, cannot fail to be struck with the difference. Those who are used to hot climates, have declared that the feel and smell of the latter exactly assimilate to those of the tropical regions.

But there is a danger attending the very success of this experiment, which cannot be too carefully guarded against.

The trial has been made in the summer months, when the temperature of the external air has not been low, nor the change from day to night very great. In proportion to the luxuriance of the vegetation will be the danger of any sudden check; and it is much to be feared, that unless proper precautions are adopted, the cold long nights of winter, may produce irreparable mischief.

I am aware that a great objection attaches to my plan of the double glass, on account of the expense; but I think that this may appear greater at first sight than it may afterwards be found to be in practice. It is, however, at all events, I submit, a point worthy of the Horticultural Society to determine; and, if the suggestion should be found to be effective, the lights of many frames, which are not commonly in use in winter, might, without much trouble, be fitted to slide over the hot-houses during the severe season; and, in the spring, when they are not wanted for other purposes, their places might be supplied at night by mats or canvass.

The principles which I have been endeavouring to illustrate should be doubtless extended to the pinery and the melon frame, in the latter of which a saturated atmosphere might be maintained by shallow pans of water. An increase in the size of the fruit might be anticipated from this treatment, without the loss of flavour, which would attend the communication of water to the roots of the plants.

I have but few additional observations to offer upon the artificial climate of a green-house. The remarks which have been made upon the atmosphere of the hot-house are applicable to it, thought not to the same extent. The plants which are subject to this culture, seldom require an artificial temperature greater than 45° or 50°; and few of them would receive injury from a temperature so low as 35°. When in the house, they are effectually sheltered from the effects of direct radiation, which cannot take place through glass: but the glass itself radiates very freely; and thus communicates a chill to the air, which might effectually be prevented by rolling mats. With this precaution, fire would be but rarely wanted, in a good situation, to communicate warmth. But in this damp climate it might be requisite to dissipate moisture. The state of the air should be as carefully watched with this view, as where a high temperature is necessary to guard against the contrary extreme.

Free transpiration, as I have before remarked, is necessary to the healthy progress of vegetation; and when any mouldiness or damp appears upon the plants, the temperature of the air should be moderately raised, and free ventilation allowed. When the pots in the proper season are moved into the open air; it would contribute greatly to their health to preserve them from the effects of too great evaporation, to imbed them well in moss or litter: as a substitute for this precaution, the plants are generally exposed to a northern or eastern aspect, where the influence of the sun but rarely reaches them; but which would be very beneficial, if their roots were properly protected. The advantage of such a protection may be seen, when the plants are plunged into the soil, a method which communicates the greatest luxuriance to the plants, but unfits them to resume their winter stations.

When a green-house is made use of, as it often is, after the removal of the pots, to force the vine, the same precautions should be attended to, as in the management of the hot-house, and the elasticity of the vapour should be maintained by wetting the floor; but after a certain period, a great degree of dryness should be allowed to prevail, to enable the tree to ripen its wood, and form the winter protection for its buds. In this, its treatment differs from that of the tropical plants, which require no such change; and to which, on the contrary, it would be highly detrimental. The same observation applies to forcing-houses for peaches and other similar kinds of trees. As soon as the fruit is all matured, they should be freely exposed to the changes of the weather.

Upon an attentive consideration and review of the subject, it appears to me certain, that a frequent consultation of the indications of the hygrometer, is quite as necessary to the horticulturist, as those of the thermometer; and it is not unworthy the consideration of the Horticultural Society, whether correct registers of the state of the climate, both in their houses, and out of doors, and a connected series of experiments upon the modifications of which it is susceptible, might not contribute something to the perfection of that art, which they are making such honourable exertions to perfect and communicate.

To me it will be a source of great satisfaction, if any observations which I have made, or may make upon the subject of climate, should prove to be at all instrumental, in forwarding their important views.

XXXIX.—*On raising Seed from the American Grass, employed in Connecticut as the material of Fine Plat. By Messrs.* COWLEY and STAINES, *Surgeons**.

SIR, *Winslow, Jan.* 27, 1825.

WE again solicit permission to offer ourselves as candidates for the favour of the Society of Arts, &c. in consideration of our having, in the year 1824, produced 8¾ lbs. of ticklemoth grass seed, and otherwise conformed to the conditions attached to the offered premium.

Our stock of grass was entirely derived from the seed you had the very great kindness to supply us with in the autumn of 1822. It was not weighed, but, as we should conjecture, the quantity might amount to 40 or 50 grains weight. The following account will explain the method of cultivation pursued.

Two large garden pots were partly filled with horse-dung, and then nearly to the tops with rich mould; on this the seed was scattered as equally as possible, but with difficulty, on account of the seeds hanging together with much tenacity by their alæ.

By way of comparative experiment, the seed in one pot was covered about half an inch in depth with mould; on the other coal ashes were laid to a similar thickness.

In about three weeks the plants appeared in unexpected numbers, having a striking peculiarity of character, resembling small white spiculæ. They were kept in the open air, but in a sheltered situation, until the February following, when they had attained the height of one to two inches, and looked very green and healthy.

A piece of loamy soil, rich, deep, and dry, was then prepared with the spade, for the reception of the plants, which were set six inches apart, in rows, with twelve inches, intervals. This was done on the 27th February, 1823, and the day or two following. The spot was afterwards

* From Vol. XLIII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The society awarded the premium of twenty guineas to Messrs. Cowley and Staines.

kept tolerably free from weeds by hoeing and weeding, repeated several times in the summer.

In the May following, we had the pleasure of seeing our plants beginning to flower, so that we had reason to expect an immediate crop of seed. However, the grass by no means flowered generally; on the contrary, perhaps, not more than one plant in fifty bore seed, which was, to appearance, small in quantity, and was totally destroyed by the hares before it was ripe: they took it off (as they sometimes do wheat) about the middle of the panicle.

By the autumn the crop had assumed the form of a thick mat, and no further trouble was taken with it until the following spring, when it was again carefully weeded. It grew luxuriantly, and was ripe, we think, at the end of July, or beginning of August, by the criterion of the yellowness of the straw; it was therefore cut, made into small bundles, and dried in the sun.

After thrashing out the seed, much trouble was found in cleaning it, as the chaff, &c. could only be separated by the hand, since it could neither be winnowed nor sifted, on account of the tendency it had to form masses, as lately alluded to.

The pot containing the coal ashes evidently bore the best plants; so that it is probably a suitable manure. With respect to the difficulty of equally distributing the seed, might not a large, and well mixed, addition of mould, or of coal ashes, very much facilitate that object?

The quantity of land set was four poles, so that the produce of an acre would amount to 330 lbs., provided it bore seed in proportion. The value of the seed we cannot speak to, as at present it has, in fact, no market price. Two agricultural societies in Germany applied to us, in consequence, we believe, of information derived from you, for some seed. We sent 3 lbs., for which we charged 8*s*. per pound; offering, at the same time, to supply them with a large quantity of roots. The seed was transmitted through the medium of a very respectable house in London.

The Society will probably agree with us, from the apparent coarseness of the straw, in thinking that our soil is too rich for the purpose of raising this grass for fine plat.—The colour, also, appears very indifferent; however, neither the time of cutting the grass, nor the after-management, were by any means such as would have been dictated by an intention of forming plat; and we hope these considerations will be received as a sufficient apology for the circumstance.

With respect to the selection of soil, we will mention a circumstance which appears to us to merit some attention, as calculated to assist in the choice. In August, 1823, whilst the ground was very wet, a narrow-wheeled waggon loaded with upwards of three tons of green poppies, passed over the plot of grass, and it was singular that in the next spring, the grass in the tracks of the wheels, and in the footsteps of the horses, assumed a widely different appearance, to the other parts, being of a much darker green colour, and of more advanced growth. In fact, it bore the same relation to the other parts which had received no pressure, as those parts of a meadow which have been accidentally manured by the cattle, do to the rest. It was evident enough that the condensation of the soil alone occasioned this luxuriance of growth, but whether it did so merely by checking the growth of those perennial runners which are produced in great numbers under ground, or in a more direct way, was not so apparent.

A very small quantity of seed was reserved from the autumn sowing, of 1822, and committed to the ground with the plants in February, 1823, in two drills, twelve inches asunder. We learned nothing from this experiment, excepting that the species of grass is strictly biennial, as in the two rows not a plant flowered. The distance apart of the drills appeared very suitable, for the ground became fully covered before the harvest in 1824.

From these experiments we deduce, that whether the seeds of this grass be committed to the earth in the autumn, or in the spring, no crop of straw, or of seed, can be expected until the second summer following; a circumstance of much inconvenience, inasmuch as a crop must be lost, and a risk incurred of rendering the land foul. Should not this view of the subject suggest a cultivation of the ticklemoth, similar to that pursued with clover, ray grass, &c., that is, by sowing it with culmiferous crops. It appears to us even better adapted to such a purpose, as, from having a large system of perennial roots, it would be less likely to perish from being over-shadowed; for the same reason it would also bear a ploughing every spring, in moist weather, without the least injury to the crop; but on the contrary, with the advantages of getting rid of the annuals, particularly of our annual indigenous grasses. In this manner we have treated peppermint and spearmint for several years with the best success; both with the plough and the breast plough, turning up the slices of the latter.

Another method of expediting the cultivation of this plant may be suggested; we allude to the planting of roots in the first instance, a practice well known in the garden, and calculated to facilitate the cultivation of the grass, by saving a year.

We are, sir, &c.

JOHN COWLEY, *Surgeon.*

A. Aikin, Esq. Secretary, &c. WM. B. STAINES, *Surgeon.*

CERTIFICATES.

SIR, 22, *Bush-lane, City, 22d Jan.* 1825.

Some time ago we took the liberty to apply to you respecting "the ticklemoth grass seed," when you were kind enough to refer us to Messrs. Cowley and Staines, of Winslow, Bucks; we now beg to say, that those gentlemen did send us, in September last, three pounds weight of the the above seed, which we have sent to our friends on the continent.

We are, sir, &c.

A. Aikin, Esq. Secretary, &c. H. W. CAMPE & Co.

January 29, 1825.

I hereby certify, that Messrs. Cowley and Staines grew, in the year 1824, eight pounds and three quarters of that species of poa, called ticklemoth, or New England grass-seed.

James Preedy, *Vicar of Winslow.*

XL.—*On the liability of the English Silks and Cottons to become faded; and on the superiority of the Silks of France and the Cottons of India in that respect. By Mr.* Thomas Allsop.

Sir, *Madras, Sept.* 5, 1825.

Among the queries submitted in my letter to you of the 28th September last*, was one (the 7th) requesting to know "why English silks or satins do not retain their colour, or whiteness, so long as those of French manufacture?" I believe the cause cannot reasonably be attributed to the change of climate, as in that case, I think, it should equally affect both:—but that of French manufacture will be found as perfectly fit for use, after a period of twelve or fifteen months, as when first imported; while the English silks, or satins, (particularly *white*), will have so completely changed as to be rendered useless for any article of dress, &c. The white will have assumed an unsightly *yellow tinge,* and those coloured will be found to have faded considerably. Although I have no pretension to any great knowledge of chemical science, I am led to imagine, that the fault originates, in a great measure, from the method used in extracting the varnish, or gum, from the raw silk; and perhaps, also, from some slight inattention in the process of bleaching it afterwards. I think it will be readily acknowledged, by even the most profound chemists, that any article, particularly so delicate a one as silk, must suffer, either more

* See Vol. VII. page 262.

or less, by exposure to the action of sulphurous acid gas, or immersion in acid, according to the degree of strength or purity of the ingredient used, as well as by the length of time the article is submitted to the action of the gas, or remains in the acid. It is, however, for those who are better qualified in this useful science to determine this material point.

The silks manufactured here are all of an imperfect white, but I believe last much longer than the English or French. The coloured silks are scarcely inferior, and stand as well as the best I have ever seen. The scarlet, purple, orange, and other coloured silk shawls, from Bangalore, are really beautiful, and the colours permanently fixed: their colours, mordants, apparatus, and processes altogether, are simple and cheap: their knowledge of chemistry but very contracted. Still, with all these apparent disadvantages, they produce articles vying in point of quality and texture even with the most refined nations in the universe.

It is also worthy of remark, that the English long-cloths, muslins, jaconnets, &c., never retain their original whiteness for any length of time, but assume a yellow tinge, like the silks and satins above-mentioned; nor do they regain it, by any process of washing. Some pieces, after a few washings, are full of small holes, and it is an incontestible fact, that one piece of good Northward 36 Penijum, will wear out three pieces of the best English long cloth. No deleterious ingredient is used by the natives to give their cloths an artificial whiteness—no chemical process is used by them. The cloths are delivered from the loom in their original state, dirty and brown; but when returned from the washerman, or *vunha*, are as white as snow. The only advantage then, is, (if it may be called an advantage), that the English cloths are much cheaper, and upon minute examination the threads will be found of a more even texture, and more regular, than those of this country. These are certainly advantages; and if some little attention were to be paid to the usual mode of bleaching, by expunging the articles likely to tinge or corrode the cloths, there is no doubt but that English cottons and linen will be of much greater consideration, and in more request, than they are at present.

I do not know how far I am correct in remarking, that I consider the mode in which the bales of cotton for exportation are generally packed, may, in some measure, account for the evils above-mentioned. I have seen them, and indeed, it is the general custom to compress a considerable quantity of cotton into a very small compass. This is effected by means of strong massive iron frames, and powerful screws of the like metal; so that when the cotton is removed, for the purpose of being packed in gunnies, &c., it is found to be almost a solid mass. Although much space may be saved thereby, on ship-board, and consequently freight money, I should imagine that the cotton must be in some way injured. If this be really the case,—and I have little doubt myself but it is,—the natives here have decidedly a very material and obvious advantage in the manufacture of cloths.

I could say much more upon this subject, but it would be a further digression from the intention with which I commenced this letter. I shall therefore briefly state, that my motive for submitting the question alluded to in the first paragraph, originated from the circumstance of my having purchased, about eight or ten months previous to the date of the above letter, a roll of white satin, and after such quantity as was immediately required had been cut off, (which was only a few yards), the remainder was carefully put by for a future occasion, which however did not occur until about the time mentioned, when I found the colour had changed to a dirty yellow. The silk was rendered completely useless!

I hope that the queries in my last will meet the attention of some of your valuable and scientific correspondents, who may favour me with the required information.

Accept my best thanks for your prompt attention to my communications, and believe me to remain,

Sir, yours truly,

To T. GILL, Esq. THOMAS ALLSOP.

XLI.—*On imitating plain and coloured Drawings, by improved Block Printing. By Mr.* WILLIAM SAVAGE*.

SIR, *Cowley-street, Westminster, 19th January*, 1825.

AFTER laying the specimens of imitations of drawings, produced by the common process of letter-press printing, before the Society of Arts, I beg that you will do me the favour to submit to the committee of Fine Arts, to which they are referred, the following practical observations on the method of printing them, and on the materials employed in the different inks.

Previous to these observations it may, perhaps, be advisable to take a short retrospect of what had been previously done, to show to the committee clearly my views of the grounds on which I presume to come forward as a candidate for a premium; for although there is no specific class in which I can claim, yet I think the second paragraph in the general notice to candidates gives me a well founded hope that they will have their merits discussed in a fair and candid manner.

The first attempts avowedly to imitate pen and ink drawings, by means of engraving on wood and printing, appear to have been made at the close of the fifteenth century. It is supposed, that at first only two blocks were used; one to give the outline and the shaded parts, and the other the coloured ground, out of which the lights were cut, to imitate their being put in with white; and this effect was produced when printed on white paper. In a very few years the process was carried further; but these early

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted its large silver medal and fifteen guineas to Mr. Savage for this communication.

productions were confined to three or four blocks, printed with different gradations of shade of the same colour, which produced the effect of what is termed *chiaro oscuro ;* their general colours were dull ochry yellow, or brown: sometimes they used a grey ink; sometimes a reddish colour, dull blue, and purple.

In many instances they did not engrave an outline, but produced their imitation of a drawing by gradations of tints, the termination of the tint becoming the termination of the subject; and the different depths produced the draperies and shaded parts.

In general, the prints of the early engravers that I have examined, have more the appearance of being coloured in distemper, than of being washed in with water colours; and in large subjects, the ground is usually broken, the surface of the paper not being completely covered, as if they had been printed on dry paper: in other instances they appear as if they had been printed in water colours on damp paper, which had caused the colours to run slightly into each other.

Whatever merit there might be in the drawing and engraving, the printing was comparatively much inferior to the productions of the press of Faust and Schoffer: for there was no great difficulty in making the lights fall nearly where they were wanted; and from the boldness of execution, it was not of material consequence to have great nicety of workmanship.

In the fifteenth, sixteenth, and seventeenth centuries, a number of artists of eminence practised this mode of engraving and printing; but in the eighteenth century the art was not much followed, at least there were few, if any, who studied it as a profession; and I only find the name of John Baptist Jackson, with the addition of John Skippe, Esq. who was an amateur.

The first instance of an attempt to engrave on wood, and to print by means of the type press, so as to represent a painting in water colours, appears to be by Jackson, who flourished about 1720 to 1754. There is another by Gubitz of Berlin, (who I believe is now living), who has produced some specimens, which I have seen, that reflect great credit on him as an engraver and printer.

I would wish to be understood as making a distinction between *chiaro oscuro* and a painting in water colours: by the latter expression, I mean a representation of some object or objects in their proper or natural colours; so that when I observe there have been only two attempts to produce imitations of paintings in water colours, it must be taken in this sense.

All the prints in colours by Jackson, that I have seen, show a failure; for the oil which he used in the ink has stained not only the paper on which the subject is printed, but also the adjoining leaves when it has been inserted in a book; and the specimens in existence remain to show, that the use of oil in coloured printing inks not only changes the colours, but also, by its separating from the colouring matter and spreading, disfigures the paper.

In the course of nearly four hundred years, since we have the first account of the origin of printing, it appears from all we can learn, that there have been only two attempts, besides this, to produce imitations of paintings in water colours by means of this process, one of which failed from the style in which the prints were engraved, as well as from the materials used in the ink.

After this transient sketch I shall proceed to the practical part of printing in colours, and describe the process and the materials by which the specimens were produced.

In selecting a drawing to imitate, it will be found desirable that the tints should be laid on flat, with as little blending into each other as possible.

When this is the case, the trouble both of engraving and printing are considerably lessened, and the copy becomes a much closer imitation of the original, than when the attempt is made with a highly finished subject, where the colours are insensibly shadowed into each other; which requires many blocks, and great attention in analyzing the drawing, to produce the desired effect.

The first step, in engraving from a drawing of this nature, will be carefully to examine it, for the purpose of ascertaining how many blocks it will require, and what parts of it will come into each. It will then be necessary to determine which part shall come into the first block to be engraved, and this is of consequence, as it will save a great deal of trouble in the progress of the work; and materially tend to the accuracy, and to the correct imitation of the drawing.

If the subject has an outline, it ought by all means to be engraved first; as it will be an easy and faithful guide for all the other parts. This outline may be traced, and burnished on the block in the usual manner; after it is engraved, an impression must be printed with black ink; and if the subject be small, it may be burnished on another block, when a tint that is meant to be taken, may be easily and correctly washed in on the block, and thus the whole subject will advance progressively, till it be completed.

If the engraving be large, or even as large as those in the specimens laid before the Society, it will be found difficult to burnish impressions from the first on the succeeding blocks; the paper, from its size, expanding so much in the operation as to prevent the united impressions fitting each other with precision when they come to be printed; to remedy this inconvenience, I adopted a plan, which I believe to be new, and which the engravers on wood acknowledge to be the most accurate method of transferring an impression of one block to another: it is, to make ready in the usual way the first engraved block, so as to produce a good impression in every part; when this is effected, to paste a piece of damp paper by the corners to the tympan sheet, and pull an impression of a full colour; then to take out the block from which the impression was printed, and substitute in its stead a similar block, prepared for engraving on, turning down the tympan, and placing some sheets of paper on it to cause a very heavy pull—then to pull the bar of the press home, and, on turning up the tympan, there will be found a reimpression on the block, more faithful than any burnishing, or even tracing, and sufficiently distinct for the engraver to touch up all the necessary parts. In small subjects this reimpression will be found very clear and distinct.

If the subject has no outline, I would recommend that the first block engraved should contain all the leading and material parts; for it will be a saving of time, occasionally to engrave on this block a little more than will be wanted to print from it, on account of obtaining the reimpression as a guide for the subsequent ones; and, after the whole subject is engraved and made accurate, to cut away those parts which are not wanted in the colour or shade of this particular block, and this remark will hold good when there is an outline.

I shall now state the colouring materials that I have used, with a few remarks on their respective qualities, when made into printing inks.

Venetian red makes a smooth ink with little trouble.

Indian red is of a more purplish cast than Venetian red, is difficult to grind smooth, but works well.

Lake is made into ink with facility.

Carmine is a richer colour, and possesses more depth than lake.

Vermilion is a colour that is generally used for red ink; it varies much in its properties and its appearance. To improve its effect, some printers mix with it orange lead, others a little lake, and some few, for particular purposes, a small quantity of carmine; but I have invariably found, in my practice, that adding lake to vermilion destroyed the beauty of both colours, and produced a brick-dust effect. Perhaps the brightest red ink that can be made, is to take the richest Chinese vermilion, and to add to it a little chromate of lead: but there is one circumstance which contributes much to the beauty of red ink in printing, that is too frequently overlooked or neglected, I mean contrast: and I think I may safely assert, that where a red ink can be introduced so as to come nearly into contact with a good black ink printed of a full colour, it shall look so superior to the same red where it is printed without any other colour on the same paper, as to appear a different composition.

Red lead is inferior to vermilion as a scarlet, but is useful to a certain extent where a duller and paler colour is wanted.

Orange lead is paler and warmer than red lead.

Prussiate of copper is a good brown in oil painting, but I found it very inferior as a printing ink.

Roman ochre is less bright than yellow ochre, but possesses more depth.

Yellow ochre is a good colour in the representation of stone, and is easily ground.

Patent yellow is a colour that possesses little body, and will rarely be found of service.

King's yellow is the colour that was in general use when yellow ink was required, till I introduced chromate of lead, to which it is much inferior, and has also a disagreeable smell.

Chromate of lead is the brightest yellow that I am acquainted with for printing ink, and is particularly easy to grind smooth.

Gamboge may occasionally be used to advantage, but as an ink it does not possess much depth of colour.

Gall-stone and Indian yellow are transparent colours, and are useful in giving mellow tints where they are wanted.

Burnt terra di sienna is useful where warm yellow or orange is wanted; also for shading yellows, and giving them depth.

Bistre is very difficult to grind smooth.

Burnt umbre, in many instances, will be found serviceable as a brown, and in giving shades to other colours in representing the ground, or where dull colours are used.— These two last mentioned articles were much used by Jackson.

Sepia is now much used by artists in lieu of Indian ink, as possessing more richness and depth, and is useful where a fine ink is required that is not of an intense black.

Indigo is a powerful deep blue, but not a bright colour.

Prussian blue is a deep colour, and brighter than indigo: they both require a good deal of grinding to make a smooth ink.

Light Prussian blue is nearly equal to Antwerp blue, without its greenish tinge.

Antwerp blue is a bright light blue, with a greenish tinge, and makes a smooth ink with very little trouble.

Verdigris makes an ink of a bright green colour.

Indian ink may be used to give the appearance of a drawing made of the same material, but it does not possess sufficient blackness necesary for the deepest parts; for them good black ink may be used.

Lamp black and ivory black are occasionally necessary; but in general the best black ink will answer the same purpose.

In addition to this list, I am convinced, by experience, that all colours used in painting may be applied to printing ink where the tone of any particular colour is required; but it will be found in practice that every colour will not produce the same tint when printed that it will when used as a water colour.

Having enumerated the colours necessary for producing imitations of drawings, I shall now give some directions for printing in this style, which are the result of my own experiments; and I wish it to be decidedly understood, that I have not been indebted to any source whatever for any practical information on this subject—the project was entirely my own, and the execution, so far as regards the printing, has been the result of a continued series of experiments, which in many instances were prosecuted for the purpose of overcoming practical difficulties that arose: these difficulties and these experiments frequently elicited new facts, and gave hints for further improvements, which I endeavoured to prosecute.

Jackson published nothing explanatory of the art. The only observations he makes, are—that he had invented a mode of splitting tints: and that he had discarded the common printing press, as not being suitable for this kind of printing, and invented one on a different construction, that was superior in its operations.

Pappillon's work, on Engraving on Wood, contains little or no information that can be serviceable at the present day. He advises the use of the rolling press, in preference to the type press; and recommends that each copy should be finished before another is commenced; at the most, he advises not to have more than twenty in progress at the same time, for fear of variations in the paper, from its drying.

An examination of old engravings on wood, printed in colours, was all I had to guide me; for I had not seen Papillon's work till I had arranged the whole of my plan, when most of the drawings were made, and many of them engraved, and did not receive from him one hint in furtherance of my views; for, contrary to both Jackson's opinion and his, I have made use of the common type press, which I have found to answer every purpose; and I think it but justice to state, that the whole of the specimens laid before the Society were printed at a press made by Mr. Ruthven, of Edinburgh, which I look upon as a valuable machine.

I have also invariably printed the whole impression from each block before I have proceeded with the continuation, without experiencing any particular variation in the paper, only adopting common precautions to prevent its drying: one of which was, to keep the edges from being too near the fire; and another, to keep the outside wrapper damp.

When wet paper was worked, I found the best method was to interleave it with damp paper, in the same manner that set-off sheets are used in fine work; for when thirteen or fourteen blocks are used, working the paper so many times will make it drier, which alters its dimensions; but when a subject requires only three or four blocks, I should work from five hundred to a thousand impressions, without any other precaution than wetting the outside wrappers at night, and perhaps, at the dinner hour, without any fear of their getting out of register.

When a subject requires many blocks, or where it is large, four points will be necessary; they keep the paper steadier in its place on the tympan than two, and serve to show any variations that may arise from the shrinking or expansion of the paper.

Sometimes there may occur small parts in a drawing of a different colour from any other part: when this happens it will save a block and the working to introduce these small parts on another block, where they may stand clear of its own tint, and to beat them of their own colour with a small ball.

It would not be practicable to give directions which blocks of a subject should be worked first, and which should succeed each other; for no specific rule would hold good, different subjects requiring the blocks to be worked in different orders. Sometimes, for the purpose of producing the best imitation of a drawing, it will be proper to work the lightest tint first, and proceed gradually to the deepest; at other times, the lightest may come last, and glaze the others; in this case it will, in some measure, take out the indentations, and soften some of the shades into each other, where it is necessary, or advantageous to the general effect.

In commencing a landscape, I should recommend to begin with the sky; as, by avoiding glazing with these light tints, the subjects of the composition will stand more distinct from the back ground than they would otherwise do if these washy tints were printed last. In proceeding to the middle tints, it will be sometimes found advantageous to omit a progressive block, particularly when it covers a large surface, and take the next in order, and perhaps finish with the one that was omitted.

In subjects of natural history, glazing will be frequently found of particular service in softening the tints into each other. This is also the case in fore-grounds of landscapes, and, indeed, wherever sharpness of definition is not required, it will be found advantageous.

In printing washy tints, the ink must be diluted with varnish to the proper tone, and very little must be used; the block must be carefully and well beat, without any superfluity of ink; if there be any, the tint will not be flat, and the ink will be squeezed into the edges of the engraved part, and give the appearance of lines. The pull must also be very strong, so as to have a great pressure on the surface of the block, otherwise there will be inequality in the colour.

Thus proceeding, the ink must be thickened with colour to match the colour required; and advance progressively to the greatest depths.

In the specimens I sent to the Society, there is an imitation of a pen and ink sketch, with a second block added, to give a tinted coloured ground, with the lights cut out, to represent a sketch on coloured paper with the light put in.

In imitation of slight drawings in sepia, I have sent a specimen with three blocks, and have increased the number in other specimens to eight, for the purpose of showing an attempt to imitate more finished drawings in this manner.

In sculpture, I have sent specimens of a bust and a statue, and also an Etruscan vase: these subjects are from drawings made from some of the finest remains of antiquity in the British museum.

In natural history there is an attempt to represent a flower, an insect, and a quadruped. The flower is not finished so highly as it might have been, but was left in this state, printed on hard-sized paper, purposely to show that, when finished by the hand, the near resemblance this process will produce to drawings, and that water colours may be used on my inks without difficulty.

In the imitation of coloured drawings, I have combined a succession of fourteen blocks; a greater number than ever was used by my predecessors in printing in colours. I had repeatedly been told that the representation of a washy tint and distances could not be produced by this process;—the sky, the water, and the distances, in the coloured landscape will, I think, refute this opinion.

In venturing before the Society of Arts as a candidate for a premium, I certainly advance no pretentions as an inventor; but rest my expectations on having extended the application of the common printing press; on having introduced additional colouring matters for printing ink; and on having introduced a simple varnish*, in its natural state, for the composition of these inks, that does not affect the colours and renders them perfectly easy in their management, nothing more being required than a stone and mullar. On my part this a first attempt to open a path to raise printing to a higher scale than was before thought practicable—that of a closer imitation of works of art, and also of nature—which will, I trust, be carried to a far greater state of perfection, and thus enable the press to decorate its own productions with an elegance and splendour well suited to that art which bestows so many blessings on man.

I am, sir, &c.

A. Aikin, Esq., Secretary, &c. WILLIAM SAVAGE.

Remarks by the EDITOR *of the Technical Repository.*

Various beautiful specimens of block printing, from drawings by John Varley, Thurston, Calcot, &c., in sepia,

* Balsam of Capivi.

Indian ink, and colours, accompanied this article, proving the great superiority of Mr. Savage's process, to others before practised. The *Balsam of Capivi* will be found a most valuable substitute for the usual vehicles employed in block and type printing, and indeed it is getting into use very considerably.

XLII.—*On preparing Potatoes in Digesters, for feeding lean Cattle, and fattening other Stock. By the Rev.* WILLIAM PIERREPONT*.

SIR, *Burton Park, near Petworth, 28th April,* 1803.

THE object of the Society for the encouragement of Arts, &c. being the general benefit of the community, I send you the following method of preparing potatoes, for the purpose of both feeding lean, and fattening other stock; conceiving and hoping from the experiments I have already made, that it will contribute something to the end which the Society has in view. Not altogether satisfied with the system of curing or preparing potatoes by steam from heated water, which I had practised, and conceiving that some better method might be found out, I made several experiments in the year 1801, and bestowed great attention and pains, before I brought the following plan to bear.

I have half a dozen common six-gallon iron digesters, which are filled with potatoes, either fresh washed from the water or dry; for I cannot find that their being in a wet or dry state makes any difference. They are then put into an oven, the bottom of which is a *cast-iron* plate, three feet ten inches long by two feet ten inches wide; under which is the fire, divided into three parts. Of this, the middle part, or division, is eighteen inches: the two other divisions are ten inches each: the remaining eight inches rest upon the brick-work. The heat is conducted,

* From Vol. XXI. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

half one way, and half the other, round the sides of the oven to the mouth, which is nearly eighteen inches square, and then over the top, uniting in the chimney, in which is placed a damper. There is also an iron rod, with a segment of a circle at one end, for the purpose of pushing the digesters into the oven from the mouth, and a hook at the other end, to draw them back to the mouth when done. The first round, that is, the six digesters first put into the oven, take about two hours in baking, supposing the fire not kindled before they are put in; and every round after the first may be done in little more than an hour. This process requires very little fuel, and by no means the attention or the force necessary for steaming; as the potatoes will be done quicker or slower in proportion to the heat applied, without any of it being lost for want of greater force; even one round left in the oven over night, with a mere trifle of fuel, will be done the next morning: but I do not allow that to be done, because it turns the potatoes black, and hurts the digesters. Observe, the digesters must occasionally be rubbed on the inside, with a little lard or dripping. Potatoes cured this way, are not by any means so apt to turn sour, or scour the cattle, and are more dry; so that the animal fed with them drinks much more, and they become harder when cold, so as to be flung to the stock with more convenience, than when steamed.

In the year 1802, I fattened fifteen brace of bucks chiefly with them; I say chiefly, for after the potatoes were gone, they had a few beans. They were very fine and peculiarly well flavoured. Biggs, at Temple-Bar, had thirteen brace of them. I also fattened, the same year, with them, two oxen, three cows, and two pigs, which were equally well flavoured, particularly the fat; the pigs had, towards the latter end, a few whole peas after each meal; the bucks had six pounds per day each, at an average; the lean deer in the park, do very well with little more than a pound per day, instead of hay. This year, that is, within this last seven or eight months, I have fattened two very large oxen, and twenty Welsh wethers; the wethers, with which there were two South-down rams, and one ewe, had eighty pounds of the potatoes per day, with a little cut hay. The ewe was put with them to teach the other sheep to eat them: she has since had twin lambs; and the bailiff acknowledges that the lambs do better than the others at turnips; though he, with some other persons, dissuaded me from trying more ewes, under the idea that the potatoes would dry up their milk. Four dairy cows never did so well with very good hay, as they did last winter, with about four pounds of the potatoes, and about four pounds of rubbishy hay and straw cut. But enough on this head.

The Earl of Egremont had two of the Welsh wethers, and a sirloin of beef from one of the oxen. The other, for sale, on the 22d of March, weighed 343 stone; he has had about forty pounds thrice a day. I take the liberty of referring to Lord Egremont for the flavour of the meat. He has seen the process; and I shall request the honour of his Lordship's transmitting this to you, in case he thinks it deserving the Society's attention.

I am, sir, your obedient servant,

To Charles Taylor, *Esq. Sec.* W. Pierrepont.

I know nothing of the expense of preparing potatoes in this manner; but I am inclined to think, that they are more nutritious than in any other mode of dressing. I did not think it possible to bring such large oxen to such a state of fatness upon potatoes.

Egremont.

Sir,

With all due acknowledgement to the Society of Arts, &c. for the honour they have done me, as communicated to me in your letter of the 27th instant, and which came to hand yesterday, I could wish the subjoined additions to be made to the account you already have. My reason for wishing it is, that any person willing to try the method in question, may profit by the general result of the many and various experiments I made, without being at the expense and very great pains I was at, before I could bring it to bear in its present form. I had not the most distant idea of using digesters at the onset of the business; neither had I, nor have I any interested motive in view, either for myself, or any other person, or indeed any motive than the benefit the public might derive from it. I have deemed it necessary and proper, both out of respect to the Earl of Egremont and myself, to make the above declaration and remark, on this occasion. The following experiment was made, for the Earl of Egremont, to ascertain the quantity of fuel, &c. as per date.

At Burton Park, 21st of May, 1803, three bushels of potatoes were weighed separately, (each bushel weighing sixty pounds) before they were put into the six digesters. The potatoes from the two first digesters, taken out of the oven, when baked and weighed together, were fifty-five pounds; those from the two next were fifty-four pounds; and those from the third two were fifty-four pounds. The carpenter measured the wood with which they were baked; and he tells me, that a cord, or stack of good fire-wood well piled, (that is wood cut into three-feet lengths, and piled twenty-four feet in length, and one foot ten inches in height, and which is sold in this neighbourhood for 12s.) will bake ninety sets, or ninety times six digesters full of potatoes, at the rate of wood it took to bake the above six, which was the second set that day. A cast-iron plate, five feet in length, instead of three feet ten inches, by two feet ten inches, will hold eight digesters; and adding a small fire on each side of the great fire-place, will, in my opinion, accelerate the baking from fifteen to twenty minutes, in every set, as well as be some saving in fuel; because the side digesters generally take that time longer than the centre ones. The merit of this process does not consist in slow simmering; for, the quicker the potatoes are done, provided proper attention is paid to them, the better. With the four following observations adhered to, any person may exercise his own judgment, and indulge his own information and fancy in erecting his oven, whether it be for a greater or smaller number of digesters, and according to the quantity of potatoes he may wish to bake.

1st, The digesters, or other vessels containing the potatoes, must not be in contact with the fire. 2d, The said vessels, even placed on cast-iron, must have legs, so that the bottoms of them do not touch the cast-iron. 3d, The lids must be steam-tight, in order to prevent its escaping before the potatoes are nearly done, with valves, if not the same, something similar to those of the digester. And 4th, the external air is to be excluded from them; and the more effectually that is done the better; both for saving fuel and time, as well as to prevent their burning. I have never had occasion for more than six bakings in a day; which six bakings, that is, six sacks or eighteen bushels, at sixty pounds the bushel, were done within twelve hours. The father and his son had 12*s*. per week, for getting from the heap, washing and baking the potatoes, cleaving the wood for ditto, and feeding stock; 1080lbs. of potatoes, are baked for little more than six parts out of ninety of the cord, or stack of wood, above described. My opinion is, that two ovens of six or eight digesters each, (according to the quantity of potatoes wanted) would answer the best purpose; particularly where coals would be used, or the wood is ready cut; for then the same person could attend both, and one would be baking, whilst the other would be emptying and filling, and this whether for a great or small quantity. Perhaps two ovens erected together, with a single brick laid flat to divide them, with two fires at the end, so that each flue would go the whole length of the plate, mounting at the other end, and so over the top into the chimney, and the two doors of them at the two fronts, would answer very well in point of economy, &c. Perhaps also an orifice just above the mouth of the oven, or in the door, with a moveable valve fixed to it, would prove useful, so that the steam which issues from the valves of the digesters, about ten or fifteen minutes before the potatoes are done, and which smells like that from roasted potatoes, might escape by it, instead of by the mouth of the oven. The above steam it attended by a hissing noise, and a kind of boiling commotion in the digesters, which the person attending them will very plainly hear on opening the door a little. When he perceives that noise, &c. begins to intermit, the digesters must be taken out, or the potatoes will burn at the bottom, and that in proportion to the degree of heat under them. A very little observation will soon make a person acquaint-ed with the proper time of drawing them. The Society for the encouragement of Arts is at full liberty to publish what they think may be useful from what I have written; for public advantage is my grand object, as well as it is theirs.

I remain, sir, your most obedient servant,

To Charles Taylor, *Esq. Sec.* W. Pierrepont.

XLIII.—*On the advantages of steaming Potatoes, as Food for Horses and other Cattle. By* John Christian Curwen, *Esq. M.P.**

In a communication from Mr. Curwen to the late Dr. C. Taylor, secretary to the Society of Arts, &c. &c. dated, Belle Isle, Keswick, Dec. 1, 1801, he says—

"I have been engaged for some time past in feeding my work-horses, and those employed in my collieries, with potatoes instead of hay: I boil them with steam. I have for the last five weeks consumed 150 stone per day, and to each stone I put four pounds of cut straw. I have

* From the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

reason to hope I shall succeed, and, when satisfied of it, the whole process shall be submitted to the public. An acre of hay produces 260 stone, and an acre of potatoes 1400 stone. Supposing the seed to be equal, the gain is immense, and would lead to very important consequences, by encouraging the growth of wheat. The potatoe culture has been hitherto found too expensive to be carried to any very great extent. From the trials I have made, I am inclined to believe the boiling of potatoes would be found to be highly advantageous in fattening cattle.

"It requires 300 acres to furnish hay for my work-horses; and, from precarious seasons, I am often subject to great inconveniences; but should potatoes be found to answer, thirty five acres will be amply sufficient."

And in another communication, dated Belle Isle, March 6, 1803, for which he received the silver medal of the Society, he states as follows:—

"In a letter, which I had the pleasure of addressing to you some time ago, I took the liberty of hinting at an experiment I was making, in giving steamed potatoes as a substitute in a great measure for hay.

"I was then wholly unacquainted with its having been tried. It was from my friend, the Bishop of Landaff, I first learnt that the Board of Agriculture had made a report upon it. As I do not find that was carried to any great extent, nor given in the way I have done, I shall, with much deference to the Society of Arts, &c. offer what has occurred to me, together with the plan I have adopted for steaming and washing. Having nothing of the kind to assist me in my beginning, I found great difficulty, and much time consumed, which I trust this will remedy to those who may be inclined to make the experiment.

"My respectable friend and neighbour, the Bishop of Landaff, took the trouble of examining the process, and inquiring into every thing relating to it, and has certified the complete succcess of the plan, and his approbation of the apparatus. It was in consequence of the alarming failure in the hay crop of the year 1801, that I found myself called upon to take some steps to prevent the serious consequences which were likely to result from it. The importations of hay from Ireland, in August, were from 9*d.* to 11*d.* per stone of 14 pounds. In this situation it fortunately occurred to me, that I had for many years given a proportion of steamed potatoes, mixed with their other food, to my hounds, and found it to answer extremely well. If hounds could stand their work with this feed, I could scarcely admit a doubt of its being a hard as well as nutritious food. Under this impression, I began my steaming in October, 1801, and continued it till late in May. The prejudices I had to encounter were such as would have defeated the plan, had I not followed it up for some months with constant and unremitting attention; and whoever attempts it, will have difficulties to contend with, that require particular attention to overcome. In no one instance did it fail, and my horses were never in such spirit and condition. In October last, I recommenced my operations, and am able to steam from 160 to 200 stone, of fourteen pounds each, per day; I have fed upwards of eighty horses constantly both seasons; and this year, I have extended the feed to my milch cows, taking away all hay, and only giving a little straw. Each horse has a stone and a half of potatoes, or twenty-one pounds, estimated at 3*d.* per stone, 4½*d.*; steaming, a half-penny; ten pounds of bruised corn, 6*d.*; five pounds of hay, 2*d.*; two pounds of cut straw to mix with the corn, a half-penny; making on the whole 13½*d.* per day. Each tub of potatoes, containing eleven stone, has one of cut straw mixed up with it; it is given warm, and a horse will eat a stone in less than half an hour, whilst between six and seven would be required to eat a stone of hay. The time gained for rest contributes greatly, I have no doubt, to promote the health and condition of the horses.

"The facility with which potatoes can be transported from place to place, is much in their favour, and being without damage, to which hay is liable, is a further object. The individual gain will be found great, where ground is highly rated and not easily procured, as will be commonly the case where horses are most wanted. In a national point of view, it may be important, should the population of the country advance as rapidly as it has for some years past. The potatoe crop is produced from ground which would otherwise be under fallow; and when proper care is taken, the wheat after potatoes is equal, if not superior, to that from fallowed ground. The year previous to my adopting my present method, I sunk the rent of my farm, valued at a thousand pounds (about 700 acres) and seven hundred pounds besides. In the last year, I cleared, receiving the same prices for my work, 2189*l.* The only difference I can point out is in the price of oats; this might deduct 300*l.* I had forty acres last year under potatoes: the wetness of the ground, and the very unfavourable season, made my crop a bad one. I shall have this year sixty. I have found no difficulty in importing from Scotland and Ireland, at 3*d.* and 3½*d.* per stone. The quantity being more than I required, I have sold to the poor at reduced prices at 3*d.* whilst the markets were from 5*d.* to 6*d.* I had 300 acres under hay, and never sufficient: I expect that 150 now will be more than sufficient for all my wants. The value of hay was heretofore in proportion to my necessity; having no longer occasion for any, the price will fall to the neighbourhood. Indeed, it has, as I might purchase at 6*d.* per stone, what was seldom or ever under 9*d.* and more frequently a shilling; I have every pound of hay weighed, so as to prevent all waste; and though this is some trouble and expense, I have reason to believe it is amply repaid by the economy it enforces.

"P.S. I make no difference in the feed of a cart horse, or one of my carriage horses; the allowance is the same. The coals for steaming 100 stone of potatoes, I have found to be two Winchester bushels and a quarter, or 187lb. of coal.

	s.	d.
One labourer also is sufficient to steam, wash, &c. 160 stone	1	8
Two Winchester bushels and a quarter of coals, at 3*d*. each bushel	0	7
	2	3

The cost is therefore under a farthing per stone, leaving a residue of 13*d*. per day, which in six months would produce £9. 15*s*.

	£.	s.
The cost of the apparatus, washer . . .	12	12
Four tubs, at £2. 2*s*. each	8	8
Boiler	5	5
Platform for the tubs	10	10
Pump	5	5
Building	60	0
	£102	0

And in another letter, dated London, March 12, 1803, he states—

"In addition to what I have had the pleasure of communicating to you, on the subject of potatoes, I wish to add a few observations, to guard such as may be inclined to make the experiment of feeding with them, against the pernicious effects of the liquor which distills from the potatoe. The first attempt I made to give potatoes to hounds, was fifteen years ago: they were boiled with their other food; but I was soon obliged to desist from it, the hounds being very violenly purged and affected by it; from this trial I was satisfied, that the potatoe liquor contained a very poisonous quality, which must be highly pernicious. Indeed, I have no doubt, if any animal was suffered to drink the water which comes from the potatoe, it would be destroyed by it. It is upon this account, I adopted the leaden cistern upon which the tub rests, and into which the steam is introduced. Though I am satisfied there is a great loss of steam by it, and an increased expenditure of fuel, yet to keep clear of the potatoe liquor mixing with the potatoes, is of the first importance. As a remedy against the loss of steam, I should advise to lengthen the steam-pipe in the cistern, so as to throw the steam to the centre of the tub, and to have a hole cut, and covered with a leaden cap, with holes for the steam to pass through, by which means the condensation will fall by the sides of the tub, and much steam be saved. The potatoes are made much dryer, by suffering them to stand a few minutes in the tub, after the steam is taken from them.

"I had so little asssistance from any thing previously done in steaming, that the first season, it required five men to do the work which one man can now accomplish with ease. It took two persons to wash them, which they did in a very incomplete manner; two to steam and bruise, and one man and a horse to furnish water. The washer will be found to answer the purpose admirably well; and when the saving of water is an object, its value will be increased. Several private families have adopted them upon a small scale, and found great convenience from it. I believe the method I have adopted of mixing a portion of cut straw, (from a tenth to an eleventh part), is highly advantageous; first, as it prevents the food passing too quickly, and secondly, as it keeps the mouths of the horses from being clogged with the potatoes. Should doubts still remain, as to the performance and health of the horses thus fed, I am ready to afford unquestionable proof from the persons who have the care of them. I shall always be ready to answer any questions, or to afford any further information in my power.

"From what I have previously stated, the advantages I have already reaped from this method will be apparent; and I cannot but sincerely wish, both for the advantage of the public and individuals, that through the medium of your most useful and respectable Society, it may come recommended to them, which cannot fail of having considerable effect.

"P.S. When the potatoes are sufficiently done, being of a heat equal to the steam, the distillation ceases, and the steam comes through the cock. The condensed water from the steam formed during the operation, is allowed to run off, affording a constant stream.

"The above statements were confirmed by certificates from the Bishop of Landaff, and Arthur Young Esq."

(To be continued.)

XLIV.—*On the Material used in Tuscany for Plat.*—*By Mr.* WILLIAM SALISBURY, *of Brompton**.

It appears that specimens of the straw, with seeds of the plant, were, in 1819, brought to this country by Captain Roper, R. N., and were presented by him to H. R. H. the Duke of Sussex, President of the Society. Some of these seeds his Royal Highness gave to Mr. Salisbury, who sowed and obtained a crop from them in the following year. The plants being allowed to come to maturity, proved to be the *triticum turgidum*, a variety of bearded wheat, which seems to differ in no respect from the spring wheat grown in the vale of Evesham, and in other parts of England.

In the autumn of 1823, M. Fournier, of Geneva, a friend of Mr. Salisbury, being about to make a journey to Florence, was requested to make enquiries for him respecting the culture and subsequent preparation of the bearded wheat, as far as regards its application to the purposes of platting.

M. Fournier states that the bearded wheat is cultivated largely in Tuscany, both for food as well as for platting; and that he saw the plant grown for its straw alone in various parts of the Val d'Arno, between Pisa and Florence. The seed is thickly sown on a poor stony soil, on the bank of the river: when the crop is some inches high, it is mown,

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted its silver Ceres medal to Mr. Salisbury for this communication.

but not very close to the ground; this treatment subdues, more or less, the rankness of the plant, and the stems that shoot up are slenderer than before. If they are still too coarse, the crop is again mown, and so on to a third and even a fourth time, according to the vigour of the plant. When the stems are sufficiently fine, they are allowed to grow; after the bloom is over, but while the grain is still very milky, the plants are pulled up and exposed to the sun on the sand of the river, care being taken to water them from time to time. When the straw is come to a proper colour, a very careful selection is made of it, according to its quality, and it is divided into several sorts, according to the size of the straw. The only part used is from the base of the ear a few inches down towards the first joint. The part between the first and third joints is reserved for common plat.

Specimens of the straw in its unprepared and prepared state, collected by M. Fournier, and given by him to Mr. Salisbury, were laid before the committee.

XLV.—*On an Improvement made by the* Editor *in viewing the Animalculæ, &c. in Fluids, with the Microscope.*

In our fourth volume, page 317, we gave an account of a facile mode of viewing the animalculæ, &c. in fluids under the microscope, invented by the Editor, and which consisted in placing upon the surface of the fluid, whilst lying upon a flat slip of glass, a thin slice of talc or mica, and which had the instantaneous effect of rendering the surface of the fluid truly plane, and preventing the evaporation of it.

Owing, however, to the capillary attraction exerted between the two plane surfaces of the glass and the talc, they approached so near to each other as not to leave space enough between them for some of the larger kinds of animalculæ, such as the wheel-animalculæ and the bell-polypes, for instance, to perform their curious evolutions at full liberty.

This inconvenience the Editor has remedied, in the following simple and facile manner:—

He heats the middle part of a slip of glass, of perhaps half an inch in breadth, and three inches long, over the flame of a lamp or candle, until it becomes hot enough to melt sealing-wax readily: he then applies a slender stick of it to the glass, making two thin and narrow lines of it adhere to the heated glass crosswise, or at right-angles to its length, at the distance of about half an inch apart, and then carries the sealing wax also along the edges of the glass, between the two first made crossing lines; the sealing-wax thus forming the sides or boundaries of *an exceedingly shallow square cistern,* upon the glass, which serves for the bottom of it. This cistern, however, when filled with a drop of the fluid containing the animalculæ, and covered with a slip of talc, is quite deep enough to allow full play to the movements of the animalculæ, whilst it evens the surface of the fluid, prevents it from evaporating, and thus enables us to keep an object in view under the microscope for hours together. The Editor has used this contrivance for several months with the greatest convenience.

XLVI.—*A method of Preserving Lime-Juice. By Captain* T. M. Bagnold*.

It is well known that the juice of lemons, or of limes, expressed from the fruit, will in a short time, especially if kept warm, become mouldy, and unfit for use as an article of food; and that the final result of this spontaneous change is the destruction of the acid itself. The acid may, indeed, be separated from the other matters with which it is naturally mixed; but in so doing all the odour and flavour of the native juice are also destroyed, for pure crystallized citric acid is wholly inodorous, and to the taste simply acid.

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

The effect of pure citric acid in preventing or mitigating the severity of sea-scurvy is greatly inferior to the recent juice; and in many of our circumnavigations, lemon or lime-juice, mixed with a small proportion of rum, about one-tenth, has been found to keep for a considerable time in tropical countries, and to be very efficacious in preserving the health of the crews. In some cases, however, this addition of spirit is by no means desirable.

In April, 1824, Captain Bagnold produced to the committee a specimen of lime-juice, which had been prepared in Jamaica in the preceding September, according to his directions. The juice having been expressed from the fruit, was strained, and put into quart bottles: these having been carefully corked, were put into a pan of cold water, which was then by degrees raised to the boiling point. At that temperature it was kept for half an hour, and was then allowed to cool down to the temperature of the air. The process, therefore, was, in substance, only the same as that which has been long practised in this country for preserving green gooseberries, and other fruits, for domestic use. A bottle being opened by the committee, the juice, was in the state of a whitish turbid liquor, with the acidity and much of the flavour of the lime; nor did it appear to have undergone any alteration.

In March, 1825, some of the same juice, which had been examined the year before, and which had since only been again heated and carefully bottled, was laid before the committee. It was still in good condition, retaining much of the flavour of the recent juice.

Hence, it appears, that by the application of the above process, the addition of rum, or other spirit, to lime or lemon juice, may be avoided, without rendering it at all more liable to spontaneous alteration.

XLVII.—*On an unwarrantable Attack, made upon the* EDITOR, *by* C. R. GORING, M.D.

IN No. XLI. of the *Quarterly Journal of Science and the Arts*, we find an "*Account of the improvements which have been made in England on the Reflecting Microscope of Professor Amici of Modena.* By C. R. GORING, M.D." at the conclusion of which the Doctor adds as follows:—

"I feel myself called upon to state to the public, that Mr. Gill has given a mutilated and surreptitious account of the instrument I have described in his *Repertory* for November last, which has moreover been copied into the *Quarterly Journal* for January, 1826, under the designation of *Mr. Cuthbert's Reflecting Microscope*, as if it had been originated by that acute and distinguished artist, instead of Professor Amici."

The Editor must ever regret, that Dr. Goring, for whom he had ever entertained the highest respect, should have felt himself called upon to pass this *harsh* and *unmerited censure* upon his account of Mr. Cuthbert's combined microscope; and which, indeed, could not have happened, had the Doctor, as he might and ought in justice to have done, previously consulted the original Article in the *Technical Repository*, vol. VIII. page 285; where the Editor had expressly guarded against the possibility of supposition, that Mr. Cuthbert's reflecting microscope had originated with himself, by stating at the commencement of the article, that "*he originally executed it on the plan recommended by Dr. Goring*;" and he even quoted the Doctor's own article, republished from the Quarterly Journal of Science, in vol. VII. page 301, of the *Technical Repository*, where the *principle* of the invention is acknowledged to be due to Professor Amici.

Unfortunately, however, in the abridged article on *Mr. Cuthbert's reflecting, compound, and single microscope*, published in No. XLI. of the Quarterly Journal of Science, that statement, and the reference to the Doctor's article, are entirely omitted; so that, without further inquiry, he might easily come to that conclusion:—for these omissions, however, the respectable Editors of that valuable work, and not the Editor of the *Technical Repository*, must be accountable.

Thus much, then, for the imputed *mutilation*:—as for the *surreptitious* part of the account, the Editor feels he has only to state, that he was expressly invited by Mr. Cuthbert himself to see his microscope, knowing that various articles had appeared in the *Technical Repository* on improvements in these valuable instruments: and indeed he took especial care to point out to the Editor's notice, that he had availed himself of the use of *a triangular bar, with rack-work at its posterior edge*, to support his stage, and also of an improved forceps, from having seen them, in a valuable improved single microscope, made for the Editor many years since, by the late scientific Mr. Samuel Varley*. He has also subsequently expressed himself much gratified with the account the Editor published of his combined microscope, and was surprised at its accuracy, considering the little time and opportunity afforded him for inspecting it. The Editor, after stating these facts, trusts thas he has fairly acquitted himself of even the slightest imputation that he had *surreptitiously* obtained the particulars of Mr. Cuthbert's combined microscope.

Having thus, he trusts, satisfactorily exculpated himself from the charge of having *surreptitiously* given a notice of Mr. Cuthbert's microscope, the Editor now calls upon the Editors of the *Quarterly Journal of Science*, to whom alone the act of *mutilating* his account is to be attributed, to take the *earliest opportunity* of setting him right with their numerous readers, as it is a serious evil to remain under such imputations for the space of three months together. And he cannot avoid expressing his opinion, that they should not have permitted such a grave charge to

* A description of which is given in this work.

have sullied their pages without due consideration; and the more especially, when they themselves had caused Dr. Goring to urge it, from their omitting the Editor's statement and reference. Neither ought Dr. Goring to have so committed himself, without first taking due pains to ascertain the facts, and which he might easily have done, as the Editor took care to furnish Mr. Cuthbert with the number of the *Technical Repository* containing the account of his microscope.

Finally, we trust that this unpleasant affair will render the Editors of the *Quarterly Journal of Science* more careful in future, that, in selecting any article for publication, *they do not omit any essential part of it:* and, more especially, *that they do not suffer any charges against individuals, founded on their own omissions, to appear in their work.*

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal since April 18, 1826.

To John Bellingham, of Norfolk-street, Strand, in the county of Middlesex, civil engineer; for a certain improvement or improvements in the construction of Cooking Apparatus. Dated April 18, 1826.—To be specified in two months.

To James Robotham, of Great Surrey-street, Blackfriars-road, in the county of Surrey, hat manufacturer; and Robert Lloyd, of No. 71, Strand, in the county of Middlesex; for a certain method of preparing, forming, uniting, combining, or putting together, a certain material, substance, or thing, or certain materials, substances, or things, for the purpose of being made into Hats, Caps, Bonnets, Cloaks, Coats, Trousers, and wearing Apparel in general, and various other purposes Dated April 18, 1826.—In six months.

THE TECHNICAL REPOSITORY.

XLVIII.—*On a Swiss method of instantly stopping the Blast from Smiths' Bellows.* *By the* EDITOR.

WITH A FIGURE.

IN our present volume, page 158, we gave an account of some valuable improvements in the mode of working the bellows of smiths' forges, invented by Mr. Duncan Campbell, so as to produce *a soft and gentle blast* from them; and indicated some of the advantages obtained thereby in welding cast-steel, &c.

We have since been favoured by Mr. M. Riviere, of Hackney, who has recently obtained a patent for *a very superior description of fine sieves,* and the machinery for perforating the metal plates forming them; with a sight of his work-shops, and the tools and methods employed by a set of excellent workmen he has just brought over to this country from *Geneva,* the long celebrated seat of *the watch and clock tool manufacture,* and indeed the spot from whence all our best processes in the difficult arts of working steel were originally imported into this country, by a colony of persecuted Huguenots, on the revocation of the edict of Nantz. Of course we did not fail to notice the different methods employed by these Swiss workmen, from those in common use here; and particularly in the very simple and convenient manner in which they converted that cheap implement, the turn-bench, the tool by which the watch-makers perform such exquisite pieces of workmanship, into a *lathe,* and without the aid of the collar and mandrel, those sources of frequent inaccuracy and loss of power from friction, but which are continually and unnecessarily employed in this country; we shall hereafter recur to this simplification of *turning bodies between two fixed centres*, instead of through the mediation of the collar and mandrel usually employed in the English lathes. In the mean time, we shall describe the improvement which constitutes the subject of the present article, and which indeed is an excellent addition to the former observations on working the bellows of forges, kindly communicated to us by Mr. D. Campbell.

In Mr. Campbell's practice, he counterbalances the weight of the upper-board of his forge bellows by means of a line affixed thereto, and which line passing over a pulley above, has a hook affixed to it, on which the necessary weights can be hung, to effect the desired object. Here a line affixed to the upper board of the bellows, and passing over a pulley, is also employed, but with a different intention. It is well known, that in the ordinary use of smiths' bellows, we have no means *of suddenly arresting their blast when required*, but must wait until it ceases, or they stop of their own accord, by the upper board gradually descending to its usual place of rest. This evil, in performing delicate operations in the forge, must have very frequently been experienced by most workmen; it is now effectually obviated, by the following excellent contrivance :—

In plate XII. fig. 1, *a* represents part of the wall of a smiths' forge-hearth; *b* an upright iron trunk or tube, secured by being spiked to the wall; within this flat tube a flat bar of iron, *c*, is placed, which slides freely up and down, guided by the tube: this bar, *c*, is suspended to a line, *d*, which passes over a pulley, *e*, the axis of which is driven into the wall, and over another pulley, affixed above the bellows, and the line is finally secured to the upper board of the bellows. The bar thus partakes of the motion given to the bellows, it descending and ascending as the bellows are raised or lowered. One edge of the bar, *c*, is formed into a rack, by angular notches being made along it; and a hook, *f*, turning upon a pin, affixed in ears, formed in the side of the tube, *b*, can be turned up at any time, and as shown in the figure, and its hooked end be caused to pass through a gap made in the side of the tube, and enter into any of the notches in the rack, which present themselves opposite to the said gap, and thus stop or arrest its motion accordingly, the blast of the bellows instantly ceasing at the desired time. On turning the hook, *f*, back again, the bellows can be worked in the usual manner without stop or impediment.

Our figure represents the upper board of the bellows as being nearly elevated to its greatest height, when detained by the hook *f*, and the bar *b*, lowered accordingly. On the bellows falling or collapsing, when released, they will, of course, raise the bar up again.

We would earnestly recommend, that both Mr. Duncan Campbell's excellent mode of *attempering or softening the blast of smiths' bellows, and this Swiss method of totally arresting it at pleasure*, be adopted, where great nicety in regulating the heat of forge-fires is required; and we cannot but think, that very great improvements might be derived from the employment of them, in all cases where it is essential to have it in our power to govern the blast from the bellows, and the consequent heat of the fire; as in the working, the welding, and the hardening and tempering of steel, for instance, and particularly in manufacturing delicate articles of fine cutlery, &c.

In the larger works of smithery, it is well known that the blast from the powerful bellows employed continues to excite the fire long after the heated body is removed therefrom; and, indeed, until the bellows have gradually collapsed. In this manner much unnecessary waste of fuel is occasioned, which might be prevented, were this Swiss mode of suddenly checking the blast to be adopted; and, besides, the bellows would begin instantaneously to act again of themselves, and with a powerful blast, on removing the catch or hook from the rack, instead of our being, as at present, obliged to wait until their upper board is filled with air, by repeated movements of the rock-staff, and the lower board or feeder of the bellows actuated thereby.

XLIX. *Observations on the Culture of Silk. By the late* ARCHIBALD STEPHENSON, *Esq. of Mongreenan, in Ayrshire.*

(*Continued from page 277.*)

WAS it possible to wind off the silk from the other cocoons before the insect naturally pierces them, that is the best time for doing it, because the silk at that time winds off with much greater ease than afterwards. But as that is found to be imposible, two methods have been pursued to destroy the insect in the cocoon, that they may wind off the silk at leisure, and with full convenience. The first method which was followed in France for that purpose, was to destroy them by placing the cocoons in baskets in a baker's oven; but if the oven happened to be a little hotter than was proper, the silk was by that means scorched, and often very much hurt by it. They therefore tried to kill the insect by the steam of boiling water, which could not at all hurt the silk, and they succeeded; so that the placing them in the oven is now wholly laid aside. The killing of the insect by the steam of boiling water is performed in the following manner.

They build a little furnace of brick, of a kind of oval form; the ground part of which is for holding the wood or charcoal which they use upon this occasion; and to make the fire burn properly, they have a little iron grate in the furnace, upon which they place the wood or charcoal; and over that, at a little distance they place a little copper cauldron, which they fill with water, and make it boil by means of the fire underneath. Above this cauldron they have another iron grate, upon which they place the cocoons, in a little open basket composed of twigs, which is made pretty open between the twigs, to let the steam and heat of the boiling water have the easier access to the cocoons. To this cauldron and the grate above it for holding the basket with the cocoons, you have access by a little door which opens above the entrance for the fire. The furnance is arched over the top with bricks, that when the door above-mentioned is shut, the steam may be retained within, which, in the space of eight minutes, is found effectually to kill the insects within the cocoons. The basket is then taken out and put aside, to let the cocoons dry, as upon coming out of the furnance, they will be all of them wet with the steam, and they then place another basket in the furnance with more cocoons, taking care so to keep up the fire, as to have the water in the cauldron always boiling. Charcoal is preferable to wood for fuel upon this occasion, because it has no smoke. The smoke of wood spoils the colour of the silk, and takes away from its lustre. The smoke of pit coal would be still worse.

Here it is proper to add, that after the insects have been killed by the steam, as above-mentioned, care must be taken to stir about and move the cocoon regularly, at least once a day. If this is neglected, the insects will corrupt, and breed worms in the cocoons, which will destroy the silk. After the cocoons are taken out of the furnance, and dried a little, as before directed, they should be wrapt up in a good thick woollen blanket, to keep in all the hot steam, and to prevent all access to the exterior air. This is done with a view to stifle any of the insects which may happen to be yet alive; and which, if immediately exposed too much to the open air, might revive and recover their strength. They are left covered up in that manner with the blanket for five or six hours together; after which they are to be taken out of the basket, and spread out upon a table; and are afterwards to be stirred, and moved about regularly every day, as directed above. And you then assort the cocoons according to their different colours, of which they have three sorts in France, namely, the white, the yellow, and those of a greenish colour.

When the insects are once killed, the sooner you wind off the silk from the cocoons the better; because it can then be done more easily than after they have been kept for some time; upon which account they always wind off the silk as fast as they possibly can; and it is done in the following manner: They build a little copper cauldron into a small furnance of brick, with a fire-place under it, as in the other furnance already described, exactly in the same manner as we do in Britain, at the sides of our rivers, for the washing of linen at our bleach-fields; at the end of which they have a large reel, which turns round with the hand, and by a foot-board, and two or three little pieces of iron at proper distances, with eyes to them, by which to conduct the threads to the reel. The cauldron above-mentioned they fill with water, and keep it always boiling with a fire of wood or charcoal; the last, however, being preferable, on account of its being free from smoke. They then put from 20 to 30 cocoons at once into the boiling water, and, with a small brush of little twigs, (of heath for example) they keep stirring the cocoons about. The heat of the boiling water dissolves the gum that is naturally about the silk, upon which, as the cocoons are continually touched and tossed from side to side amongst the water by the little brush, the ends of the silk attach themselves to the brush. When the woman who manages the brush perceives that she has got hold of the ends of the silk by it, she takes hold of the silk thread with her hand, puts aside the brush, and pulls the silk towards her, which disengages itself with ease from the cocoons; and this she continues to do till she has got away all the floss or outside silk of the cocoons. When she observes she is come to the fine silk, she breaks off and separates the coarse from it, which coarse silk she puts aside. She then applies her brush again till she has got hold of the end of the fine silk, all of which she sets apart, every fine thread by itself, by fixing it to a piece of wood kept near to the furnace for that purpose, till she has arranged the whole, or at least the greatest part in this manner, which by that means are in readiness to be thrown in, to form the thread of silk which is to be wound off.

This done, she puts together the threads of as many of the cocoons as she inclines, according as she wants to make the thread fine or coarse. These she joins together, and after having put the silk through one of the eyes of two of the pieces of iron which are placed for conducting the thread to the reel, she fixes the silk thread to the reel; upon which another woman, who attends to manage the reel, begins to turn it about with her hand, and keeps it in motion by applying her foot to the foot-board, and by this means winds off the silk from the cocoons, which is done with great swiftness.

As soon as one or more of the cocoons are exhausted, the woman who manages the cocoons in the cauldron or bason, supplies their places from time to time with others, taking care while these are winding off to prepare others for keeping up a continual supply; and taking care also to observe, that the silk winds off regularly from all the cocoons she puts in play together.

As she is obliged to have her fingers almost every other instant amongst the boiling water, in order to manage the cocoons properly, she has a bason of cold water at hand, into which she dips her fingers alternately with the other, to prevent scalding them. But in spite of her best care, a woman who works any time at this management finds her fingers at least so affected by the influence of the boiling water, that they are for some time in such a state she has scarce any feeling with them; but this afterwards goes off gradually.

Here it must be observed, that in forming the brush before mentioned, great care must be taken to have the points of it exceedingly small; because if the points are large and coarse, the silk will not take up fine from the cocoons, but will rise off thick and clotty, which will prevent its winding off properly upon the reel.

The winding off the silk is always performed in the open air, generally in some garden to prevent any accident from the fire, and more particularly to prevent any bad effects from the bad smell of the dead worms, which stink prodigiously. For these reasons, this work is not suffered to be performed in any large town, but must always be done without the walls. When the day's work is over, they make a fire of brush-wood, into which they throw all the dead insects, which are taken from the bottoms of the cocoons, opened with a pair of scissors for that purpose, and burn them together, in order to prevent any bad consequences from their stench and smell. This is done every night regularly, before the work people retire for the evening. As the manufacturers of the silk, and merchants who want to sell it, buy up large quantites of the cocoons, some of these people will have from ten to twenty of these little furnaces going at a time in the same garden, and even sometimes more.

As the whole of the silk cannot be entirely got off by the reel, what remains upon the dead insect is put aside, with the coarse part of the silk, which is taken from the cocoons in the beginning, till you meet with the fine thread which is proper for the reel.

The dimensions of the stove and bason made use of at Montauban, and described above, are as follows:

Height of the stove from the ground, twenty-two inches and one-fourth part of an inch.

Length of the stove, twenty-nine inches and a half.

Breadth of the stove, twenty-four inches.

Height of the iron bars for supporting the charcoal from the ground, for holding the fire, twelve inches and one-fourth part of an inch.

Width of the door, or opening, at the bottom of the stove, for taking out the ashes by, and for giving air to the fire, nine inches and one-fourth part of an inch.

Width of the door, or opening, at which you put in the charcoal, for supporting the fire, seven inches and a half.

Length of the oval copper bason, which is built in on the top of the stove, for containing the hot water, in which the cocoons are put when they wind off the silk, twenty inches and three-quarters of an inch.

Width of that bason, sixteen inches and a half.

Depth of the bason, three inches and three quarters of an inch.

Breadth of the rim of the bason, one inch and one quarter of an inch.

Here I might have given the dimensions of the Italian reel for winding off the silk, being the same which is used for that purpose in France; but that becomes unnecessary, as I find that the Society are already in the possession of a model of it. I shall therefore proceed to mention sundry particulars which relate to the winding off the silk.

Spring water or rain water, as being soft, is the only proper water to be used in the bason. Draw-well water is altogether improper for this purpose, because it is hard, and does not properly dissolve the gum which is naturally upon the silk.

The water in the bason must be wholly changed twice a day; it is filled in the morning before setting to work, and the second time immediately before the people go to dinner, as it requires some time to make it boil.

When you first put the cocoons into the hot water, if the silk rises thick upon the brush, it is a proof that the water is too hot. If you cannot catch the threads of silk with the brush, it is a sign that the water is too cold.

When the cocoons are in play, if they rise often to the little iron conductors, it is a proof that the water is too hot. If the cocoons will not follow the thread, it is a sign that the water is too cold. By attending to these observations, you can easily manage so as to give that degree of heat to the water that is proper for the cocoons.

If there should happen to be any sand amongst the water in the bason, the heat makes it rise to the surface, where it fixes itself upon the cocoons. This is easily known, because where there is any sand upon the cocoons, it makes the thread break, as if cut with a knife. For this reason the utmost care must be taken to guard against it, by cleaning the bason with the greatest attention. The fear of having sand is one of the reasons for changing the water of the bason at mid-day, and even oftener, if found to be necessary. When they find that there is a little sand, and that they wish to avoid changing the water, on account of the loss of time which that operation requires, as the water must be boiling before you can go on with the winding; I say, in this last case, they cover the face of the brush all over with a parcel of the coarse silk, which is laid aside, and you then put the face of the brush into the water, making it reach the bottom of the bason, along which you draw the brush gently, to catch hold of the sand with the coarse silk, to which it will immediately cling when it comes in contact with it. You then drag the brush gently up the side of the bason, and thus bring out the sand along with it. This operation, several times repeated, cleans your bason of the sand, without your being put to the trouble and loss of time in changing the water.

Take care to keep up your fire under the bason in such a manner, as to secure having the water always of the same degree of heat, and to throw in your addition of cold water by little and little at a time, so as it may make as little odds as possible in the degree of heat. When you throw in too much cold water at a time, so as to alter the requisite degree of heat, the silk of the cocoons which are in the bason at that time, loses its colour, and grows perfectly pale; which silk, so rendered pale, it is said will not take any dye properly, which by that means diminishes the value of your silk.

In beating the cocoons in the bason with the brush, you must carry your hand as light as possible, so as just to touch the cocoons slightly. If you beat too hard, the threads of silk, in place of coming off singly, cling together in lumps, which, as it prevents its winding off, occasions the loss of the silk, as it will then only anwser as waste silk.

When you take the fine threads to throw them to that which is winding off, they must not overlap your finger more than an inch; if too long, they will not join well, but hang down and occasion a lump, which causes the thread to break, as it is then too large to pass through the eye of the little iron conductor.

In winding off the silk you must be attentive to keep the thread wet, to make it slip along the more easily towards the reel. And when the wheel has remained any time idle, you must also wet all the thread betwixt the bason and two pieces of iron, which makes the thread run the more easily.

Be attentive also from time to time to wet with water the cord, and the little wooden wheel, which moves the wooden regulator, in order to make it act properly. If this is neglected, the cord, by being dry, will not turn the regulator as it ought, by which means the silk will be placed unequally upon the reel, which may have this farther disadvantage, to cause the silk threads upon the reel to cling and stick to each other, by having been brought into contact before the first threads have had time to dry. For that wooden regulator is calculated to place the threads in such a manner upon the wheel, as to make them touch one another only obliquely, and in as few places as possible at first, that the silk as it comes from the cocoons may have the time requisite to dry, before it comes to be fully in contact with that which follows. When the silk threads cling together, by being too soon brought into contact, the silk is rendered good for nothing.

The cocoons called satiny, from their resemblance to satin, require only that the water should be moderately hot in the bason. The same degree of heat that is necessary for the fine cocoons, would entirely spoil the others by making the silk come off thick, and what they call *bourry*. You find out the degree of heat necessary for these, by examining with care in what manner the silk comes off from the first quantity of cocoons you put into the bason; and if you find it comes off thick, you must add cold water by degrees, till you find the just proportion for them. They must not be allowed to remain long in the hot water, and there should only be a few of these cocoons put into the water at a time. If these circumstances are not attended to, the silk comes off thick, as already mentioned, which, in winding, makes the thread break at every moment, and not only greatly diminishes the quantity of your silk upon the reel, but also considerably hurts its quality, by rendering it coarser.

When once the reel has the quantity of silk upon it you judge to be sufficient, the produce of about three pounds of cocoons, for example, you take it off, and put another reel in its place, that the work may not be interrupted. The silk ought to remain for six or eight hours, or even more, if you can allow it with your convenience, as it ought to be perfectly dry before it is taken from the reel.

When the cocoons which were first put into the bason are nearly finished, you must cause the wheel to be stopped; at which time, with a ladle, full of holes like a drainer, you take out the cocoons which were in play, each parcel on the opposite side. They are put into plates kept at the side of the furnace for that purpose; and are taken out of the bason for the following two reasons: first, that they may not be mixed with the new cocoons, which are put into the bason to be prepared for winding, as already mentioned; secondly, because if these cocoons, which are already in part wound off, were left in the boiling water till the new ones are prepared, it would have the effect to prevent the silk from winding off from the cocoons with that dispatch and propriety which is necessary in that operation.

As soon as you observe that the silk is wound off from the cocoon, you must take out the bottom of the cocoon containing the insect from the bason and throw it aside; because, if left in the bason, it will spoil the water, and consequently destroy the colour of the silk.

You must be at pains to keep an equal number of cocoons working at each end of the bason, in order to keep the thread of silk of an equal size. When you have fewer on one side than the other, the silk becomes smaller at that side, of course, which also has the constant effect to break the thread. In order to keep the thread at both sides of an equal size, you must throw in the cocoons, one by one, and never more than two at a time. If you throw in many together, for example, four or five at once, it throws the weight to that side, when the thread immediately breaks, because by that means the equilibrium is lost.

In putting the silk thread round the two little pieces of wire, for conducting it to the reel, fixed to the little wooden wheel, you must turn the thread round to the right-hand for the bit of wire placed on the right; and turn it round to the left-hand, for the piece of wire placed on the left. In mentioning the right and left, I mean the right and left-hand of the woman as she sits managing the cocoons in the bason.

The quicker the motion of the wheel is, the better the silk winds off, and the better the ends join to the thread, which is, indeed, one of the great reasons that makes it wind off well. One might be apt to imagine that the rapidity of the motion might overstrain and break the thread, but from constant experience it has been found that the thread never once breaks from the rapidity of the motion; but, on the contrary, that the quicker the motion is the more advantageous it is for winding the silk.

When you have put the quantity of silk upon the reel which you think proper, you then pick and clean off all the loose silk with your fingers; after which you take a little handful of the coarse silk, and after washing it to make it thoroughly clean, and squeezing it, you must dip it in some cold clean water, with which, in the flat of your hand, you rub over the silk upon the reel, a great many different times, all round the reel; stroking up also the silk with the flat or palm of your hand. After which you then pour some clear cold water also upon the silk; and you then turn round the reel with all the velocity in your power, for about eight or ten minutes, in order to shake off all the water effectually; which done, you take off the reel, and put it in some airy place to dry; but you must not expose it to the sun, which would quite eat away and spoil the colour. This is done to clean the silk effectually, and to give it a gloss.

In preparing the double cocoons for winding off, they put more of them into the bason at once than of the finest kind. But before putting them into the bason, they must be well cleaned from all the floss, or waste silk, which is on the outside of them, that they may play properly in the bason. The water also must be boiling hot; and as the silk they yield is of a coarser quality than the other, and has a good deal of the floss silk or *bour* upon it, the girl who turns the wheel takes the opportunity, while the other woman is preparing the cocoons in the bason for winding, to clean and pick off the loose silk from that which is already on the reel.

In winding off the fine silk, there are always two hanks of silk put upon the reel at the same time. But in winding off the silk from the double cocoons, they confine themselves to one hank only at a time upon the reel.

The next object which occurs, is the method observed by the French, in the preparation of their floss, or waste silk, which they call *piloselle;* and which they do in the following manner: All the cocoons which have been pierced by the butterflies being collected together, they add to these all the light cocoons, which they judge to be improper for winding off, after the insects have been cut out, as before mentioned; and to these they also add all the bottoms of the cocoons which had been thrown aside from the bason, after winding off their silk.

Such of the floss silk as you wish should retain the yellow colour, you put into a large copper kettle, and cause a person to tramp it with her bare feet, in the same manner as the women in some parts of Scotland tramp their linens when they are washing them. From time to time they turn the cocoons upside down with their hands, and so go on tramping them again with their feet. This operation is continued for nearly two hours together, turning them, and giving them a little more fresh water from time to time, till it is found that the silk of the cocoons separates properly, upon tedding it out with your fingers; and as, in tramping with the feet, the edges of the heap of cocoons will very often escape the stroke of the foot, you turn the edges into the middle, from time to time, to receive the benefit of the tramping equally with the rest.

(*To be continued.*)

L.—*On the advantages of steaming Potatoes, &c., as Food for Horses and other Cattle.* By John Christian Curwen, *Esq., M.P.*

(*Continued from page* 314.)

WITH PLATES.

References to the Engravings of J. C. Curwen, *Esq.'s method of steaming Potatoes for the use of Cattle.*

Plate XI. is a ground plan of the steaming shed; A, the well from whence the water is furnished to wash the potatoes; B, the spout, which conducts the said water to the reservoir, where the potatoes are washed; C, the frame of the potatoe washer, and reservoir of water; D, a hollow wooden cylinder or barrel, hooped with iron, and perforated with oblong holes; it has a door at D, to allow the potatoes to be put in or taken out; it is of such a size, that eleven stone of potatoes will fill about two thirds of it, which quantity it will wash in two minutes; it may be used six times, or wash sixty-two stone of potatoes before the water in the reservoir need be changed. When the potatoes are taken out of that water, either pump upon them, or throw a pail of clean water over them; and let it drain through them; E, the winch or handle, which works the washer by means of a small pinion, F, working in a larger toothed wheel, G, ocoocasioning one revolution of the washer from two of the handle, as shown more fully in the subsequent plate; H, the conduit, through which the dirty water is conveyed away from the reservoir; I, the circle, in which the crane, K, moves (see plate XII.) from its centre at K, and in tracing which circle the washing cylinder, when lifted from the water, is conveyed to the potatoe-back or place of deposit, L, which is raised from the floor the height of one of the tubs, or will meet one of them at the other circle, M, so that the other crane, N, (see plate XII.) may convey the tube from thence to one of the leaden vessels, O, on which the potatoes are steamed; P, the brick-work of the water-boiler, in which the steam is formed; Q, the grate, on which the fire is made; R, the leaden steam-pipe, one and a half inches in diameter; a branch from which enters each of the vessels, O O O O, made of sheet lead, and on which vessels the tubs containing the potatoes stand, whilst steaming; S S S S, the cocks, which let out the water condensed from the steam, and impregnated with the juice of the potatoes; T, the conduit, which conveys away the water; V, the frame-work or stillage, on which the leaden vessels stand, about ten inches higher than the floor; U U, the stone troughs in which the potatoes are bruised after being steamed, and before they are given to the cattle.

Explanation of the Elevation of the Steaming Apparatus, fig. 2, plate XII.

C, the back, or reservoir of water, for cleansing the potatoes; D, the wooden cylinder, or barrel, which, by turning the iron axis extending through it, washes the potatoes contained in the cylinder; it is here shown in the state ready to be raised by the crane and jack K, from the dirty water; it can be disengaged from the toothed wheel, G, by a jointed notch between the headstocks at W; E, the winch-handle; F, the pinion; G, the toothed wheel on a line with the axis of the cylinder; X, a water-back, or cistern, above the boiler, supplied from the pump, Y, by the spout, Z; N, a crane and jack, by means of which the potatoes, when washed, are conveyed to the steaming vessels; 1 1 1, three of the wooden steam-tubs, with perforated bottoms, placed on the leaden steam-vessels, or cisterns, O O O; 2 2, the boiler for the water, formed of two cast-iron pans, screwed together by two flanges; each pan is in capacity forty gallons; R, the leaden pipe, which conducts the steam from the boiler to the steam-vessels; O O O O, the four leaden steam-vessels, each twelve inches in diameter, and nine inches deep; one of them is shown separate from its wooden tub; 3, a cock, which conveys water by a pipe from the reservoir to nearly the bottom of the boiler; 4, a cock, which stops the steam when the potatoe tubs are taken off; 5, a safety-valve, fixed upon the top of the boiler, an dloaded with a weight of about four pounds to a square inch; 6, a cock fixed in the side of the boiler, to ascertain when it contains a proper quantity of water; 7, one of the potatoe tubs, detached from its leaden vessel; it is two feet high, twenty inches wide at the top, and seventeen inches at the bottom; it will hold eleven stone of potatoes. The boiler will steam the four tubs of potatoes sufficiently in fifteen or twenty minutes time, and if the whole are not in use, the lead pipes of those not wanted may be plugged up. Each tub and cover is held down by four levers, and an iron bar at the end of each lever.

When the potatoes are sufficiently boiled by the steam, the crane, N, raises and removes the tubs from their places to the stone troughs U U, plate XI.; and a section of one of which is given at U, in plate XII. The potatoes are then bruised for use.

DEAR SIR*, *Workington Hall, Nov. 14, 1811.*

Your esteemed favour, enquiring how I am employed, seems a hint that I am supposed to be idle, or that my ambition is become extinct; I can assure you, neither the one nor the other is the case. After the kind and liberal manner in which I have been treated by the Society of Arts, &c., I should be sorry to interfere, by competition, with those who are beginning their career; at the same time, for any matter which I conceived might be beneficial to agriculture, there is no channel, in my opinion, through which it could be brought before the public, with the same chance of being favourably received, as under the auspices of a society, which has rendered such great and important services to the empire.

In the prosecution of the system I have practised for some years, of giving cooked food to all animals, the main impediment has been the cost of labour and fuel; to lessen the one, and simplify the other, have been my constant endeavour; in this, at length, I conceive I have been completely successful; and that I have thereby removed those obstacles, which were opposed to its becoming generally, and I should say, universally useful. Under this conviction, I beg leave to submit to the inspection and consideration of the society a drawing of one of the steamers, containing 100 gallons, as now used at the Schoose farm.

Each of the two steamers which I use has three boxes, containing eleven stone each of chaff, (the husks of corn), which, in boiling, gains somewhat more than two-thirds of its original weight. Wheat chaff, which alone I

* For this valuable communication the Society voted its lesser gold medal to Mr. Curwen. The figure of his apparatus will be given in our next number.

use, is commonly thrown upon the dunghill, as of no value but to augment the quantity of manure. It requires three hours to be sufficiently boiled. The same boiler works two sets of boxes; by the various stop-cocks the steam can be made to work either one, two, or all three boxes of each set.

The usual consumption of fuel is two pounds per stone. I estimate the quantity done every day at the Schoose to be equal to one hundred stone, or thirty three of chaff, which takes sixty-six pounds of coal. As the expense of coal is not great here, I should not suspect much economy is practised; even at the price of coals in London this would not be above sixteen shillings per week. Two pounds of oil cake are allowed to each stone of chaff. The milch cows and oxen are fed twice, morning and evening, having an allowance of one stone at each time. When taken from the steamer, the food is put into wooden boxes, which are mounted upon wheels to be drawn by a horse. As the chaff and liquor require to stand some time to cool before fit for use, there must be several of these boxes to put the chaff in when taken from the steaming boxes.

The cost of food for each milch cow per day.

	d.
Chaff, two stone, steaming, &c.	1
Oil cake, four pounds, ...	4
Eight stone of turnips, 14 lb. per stone, . .	4
Wheat straw	1
Total	10

The average of milk on a stock of thirty-six milch cows, was nearly thirteen wine quarts for three hundred and twenty days; one hundred and forty-two thousand quarts were sold in fifty-two weeks, ending the 20th of September last, selling price 2*d.* per wine quart. The calves brought from 2*l.* to 5*l.* each for rearing. The produce is nearly half clear profit, estimating the manure as equal to the labour. The milch cows are never suffered to be turned out. To prevent their being lame, some attention is requisite to have their hoofs properly pared, and that they stand with their fore feet on clay.

The condition, health, and milking of the cows, fed upon this plan at the Schoose, has created a considerable interest, and called forth particular attention from numerous visitors. The contrast between the condition and milk given by these cows and those fed on grains, as most if not at all are in and about the metropolis, seems an object well deserving attention.

Most, if not all, the milch cows at the Schoose are in such a condition, that a few weeks' feeding after they are dry, makes them fit for the shambles, with very little loss from the first cost.

Compare this with the state of the London dairy;—what may be the average loss by deaths I know not, but when done milking, their value for fattening is very little; they are so low in condition. As a substitute for chaff and oil cake, I should recommend cut hay; this steamed would make a much superior food; and, I entertain no doubt, would greatly augment the milk, as well as benefit the health and condition of the cows.

It has struck me, that the sugar wash might be found of great service for boiling the hay.

As I have never seen an instance when cooked food has not produced a striking improvment in the condition of cattle, I am strongly preposessed in its favour. My representations have had their effect with one gentleman, Mr. Isaac Franklyn, who has a dairy farm at Oxgate, on the Edgeware-road, 4½ miles from Paddington turnpike; and who lately had a dairy in Henrietta-street, Cavendish-square. An apparatus, made here, is on its way for him.

In order more fully to satisfy the society that this statement does not rest on a prejudice, natural to every projector of any plan, I beg to refer to Mr. Tubbs, who, on seeing the dairy at the Schoose this summer, was so struck with the condition of the cattle, that he promised to use his influence with Mr. Welling, to attend the meeting in September. Nor shall I rest on the respectable authority of Mr. Tubbs only; but refer also to Sir George Paul, Bart., who will recollect, that before he saw the milch cows, I observed to him, that if the condition of the whole stock did not surpass any he had ever seen, I was ready to admit my system had failed. I need scarcely observe, that the strictest attention is necessary to see the cows always kept clean, and never to suffer the least heat to appear upon their skins, without an immediate application of black soap and water. They are also regularly carded or curried, and care taken in keeping them in a regular degree of temperature. Any considerable change affects their milking. I give cooked food from October to June, nearly eight months out of the twelve.

No branch of farming is so profitable as the dairy, when properly and well managed. By the mode I propose, I flatter myself there would not only be a great saving in expense of feeding, but also in the depreciation and loss sustained on the capital, with an augmentation in the quantity and quality of the milk; I find that twelve wine quarts of the Schoose milk will give from sixteen to eighteen ounces of butter, which is little inferior to what can be got at the height of the grass. Much, in my humble opinion, is to be gained both by the individual and public.

Milk in London, from its present price, must be considered as a luxury. Reduce the expense of procuring it, lower the price, and more than double the quantity might be sold, with the greatest benefit and comfort to the bulk of the community. This object is attainable, leaving a handsome and liberal profit to the cow-keeper and I verily believe would be effected by the system I propose.

The plan I have now the honour of submitting to the society has been adopted by Mr. Harley, of Glasgow; by

Major Ferrand, and the Reverend J. Penny, in the West Riding of Yorkshire, and many others; and in every instance it has been found most completely to answer.

I have the honour to be, &c.

To Charles Taylor, *Esq. Sec. &c. &c.* J. C. Curwen.

(To be continued.)

LI.—*On the mischiefs arising from the great increase of the Meadow Ranuncules, or Butter-cups, and on the necessity of taking speedy measures for their extirpation.* *By* Charles Whitlaw, *Esq.*

Sir, *No. 23, Finsbury Circus, May* 19, 1826.

The *ranunculus acris* is, perhaps, the worst of this numerous, and generally mischievous family of plants, and I shall therefore select it as an example of their poisonous qualities. It is of the class of *multi-siliquæ,* according to Linnæus's system, and which class contains a long list of plants, highly destructive to life, and productive of some of the most formidable and painful diseases with which the human race is afflicted.

From various experiments which I have made, I have no doubt that these plants form the principal cause of the present alarming increase of cancer; and I consider this as the most appropriate time to point out their poisonous effects to the public notice, as the plants are now in flower, and possessed of their most active properties; and are now, no doubt, extending their baneful effects to many thousands of the population of this country.

The mediums, through which these noxious effects are communicated to the human constitution, are, chiefly, the fatty parts of meat, and butter; and more especially, to those constitutions termed bilious, where their ravages make their appearance from the age of thirty-five to fifty-five.

As a knowledge of the laws of life and health generally forms no part of the education of the inhabitants of this country, so it is no wonder that most of its fields are covered with noxious weeds. Their mischievous effects upon the health of their occupier, his family, and his fellow countrymen, never enter into the calculation of the farmer; whose thoughts are chiefly employed in contriving how to make the most money of his produce, to enable him to pay his rent.

In my late travels through Bath, Bristol, Chippenham, and their adjacent countries, I found that cancerous disorders prevailed to a greater extent than I had ever before witnessed. I, in consequence, expostulated with the farmers, on their allowing such poisonous plants to over-run their gounds. They replied, that they were very profitable, for that they made the meat fat, and the butter of a fine yellow colour. I, however, found, that when cows in calf were put to pasture in moist, or bottom meadows, they very frequently cast their calves; and also, that hard lumps were often formed on their udders, and they became so sore, that they could not milk the cows without previously tying their legs. Their milk became perfectly ropy when the rennet was put to it, and also when it was poured into tea; the farmers had frequently observed these circumstances, but without being able to account for them. I have, however, often seen them occur, in the neighbourhoods of the different metropolises of the United States of North America, where the noxious plants had been introduced with the hay-seeds brought from Europe, and they are now become extensively dispersed all over the surrounding country. Thirty years ago, when I first began to notice their progress, cancer was nearly unknown there; but it has now increased with the increase of those plants: and I have no doubt, that, in time, it will prove as terrible a scourge there, as it is in this country.

I have, for many years past, been lecturing on botany, in most of the States of the Union, and also engaged in making experiments on vegetables, to ascertain their effects upon the human constitution. In the year 1818, when lecturing at the college of Columbia, in South Carolina, I made experiments on numerous animals, in order to ascertain their specific action. A gentleman planted the *ranunculus acris* in his garden, and its seeds were dispersed all over his farm: I tried the effects of the plants upon cats and dogs, internally, and also applied them externally, to the skin, on the insides of their thighs; the results proved fatal in every instance. This plant has been recommended by various writers, both ancient and modern, as a vesicatory; but the uncertainty of its action upon different constitutions, has deterred medical men from employing it. Three young gentlemen, who attended my lectures, nevertheless, bruised some of the plant, and applied it to their legs; the first had light hair and blue eyes, and was of a naturally good constitution; he was fond of acids, fruits, and vegetables; he applied the plant for twelve hours, when it produced a slight inflammation, but without raising a blister, and its action subsided without producing any inconvenience:—The second gentleman was of a rigid temperament of body; after twelve hours application of the bruised plant, a number of well filled blisters appeared; and which, upon being cut open, and dressed, healed as kindly as any I ever saw:—The third gentleman had dark eyes and hair, and was of a bilious habit, and had a sallow complexion; he was very fond of butter, and fat meat; and, particularly, of pork; and was of a costive habit. The bruised plant, on application, excoriated and inflamed his leg, and it became so painful that he tore it off before morning: it, however, produced a foul, ill-conditioned ulcer, and discharged a foetid ichorous matter; and indeed baffled all our medical skill, so that I was obliged to have recourse to a native Indian, who healed it in a short time. The general appearance of the ulcer greatly resembled cancer, and I was strongly impressed with the idea, that the ranunculus tribe of plants was the chief cause of that painful disease.

The best way to experience the effects of butter, when impregnated with these poisonous plants, and then often admired for its fine yellow colour, is to lay a bit of it, the size of a nut, upon the tongue, for eight or ten minutes, and until it melts; and then to expose the tongue to the action of the air for some time. This experiment will soon convince any one who makes it how the stomachs of those invalids, who are afflicted with indigestion and its long train of disorders, must suffer from eating such noxious food; and particularly those who are affected with giddiness and head-aches; which disorders have greatly increased since the increase of old pastures and meadows, where the butter-cups and other noxious weeds root out the wholesome grasses. I think the legislature of this country could not perform a more humane or important service, than to cause a series of experiments to be made, with a view to the ascertaining these evil effects; and if the results should prove confirmatory of my opinion, then to enact such ordinances as should tend to the employment of the labouring poor in ridding the kingdom of such pests, and enabling wholesome plants to take their places; and thus to supply us with good and wholesome milk and butter.

Another way of testing such noxious butter, is, to melt it, and keep it at the temperature of blood-heat for twenty-four hours, and, at the same time, exposing it to the full action of the air; if the tongue, lips, nose, and hands were then to be anointed with it, I have no doubt but that the propriety of as speedily as possible clearing the fields of the poisonous plants, causing such ill effects, would become most evident.

I refer your readers for a farther knowledge of these poisonous plants to "Salmon's Herbal"—"Culpeper's English Physician"—"Orfila's Toxicology"—"Woodville's Medical Botany," and "Krapf's Experiments," published at Vienna in the year 1766; and, especially, to "The American Medical Botany" of Jacob Bigelow, M. D. published at Boston in the year 1820, and remain,

Sir, your most obedient servant,

To T. Gill. *Esq.* CHARLES WHITLAW.

We subjoin the following extracts from Dr. Bigelow's "American Medical Botany," (kindly furnished us by Mr. Whitlaw, for that purpose), upon the *ranunculus bulbosus*, or bulbous crowfoot.

"It is a remarkable fact, that a great portion of the *weeds*, which are most troublesome in the United States, are of European origin, having introduced themselves since the discovery of this country. Some of these emigrants have settled in our grazing and mowing lands, such as the *ranunculus bulbosus, acris*, and *repens*, indiscriminately called *butter-cups, crowfoot*, and *yellow-weed*; the *chrysanthemum leucanthemum*, or white-weed; the *rumex acetosella*, or sorrel; the *hypericum perforatum*, or St. John's wort, &c. In our corn-fields and gardens are quartered the couch grass, *triticum repens*; the different species of goose-foot or pig-weed, *chenepodium*; the dock, *rumex crispus*, &c.; the charlock or wild raddish, *raphanus raphanistrum*; bur-dock, *arctium lappa*, &c. Some have commenced their inroads within a few years, such as the *cnicus arvensis*, improperly called Canada thistle; the *genista tinctoria*, or dyers' weed, &c.—In return for these introductions, we have sent them the *erigeron Canadense*, and the prolific families of *ambrosia* and *amaranthus*.

"No race of plants is more familiarly known than the ranunculi. Of numerous species, both native and imported, which we possess, several resemble each other so nearly as to pass with common observers for the same plant. The great similarity of their properties, renders it almost unnecessary, in a medical or economical point of view, to distinguish them. I have selected the bulbous rooted species, not because it is more active in its properties than many others, but because it is one of the most common, and best known.

"The genus belongs to the class *polyandria*, and order *polygynia*. It is found in the natural orders *multisiliquæ*, Linn. and *Ranunculaceæ*, Juss. Its generic character is formed by a *five leaved calyx*; *five petals, with a melli-*

ferous pore at the base of each; the seeds naked. No genus can be more strictly natural than this. A general resemblance pervades the whole of the species, which indicates their consanguinity at sight. The nectary, the never failing concomitant of this genus, is a small cavity at the inside of the claw of each petal, generally covered by a flat scale, sometimes surrounded with a small brim, and at others inclosed in a short cylinder. *A subtle and violent acrimony,* on which the medical properties seem to depend, is found in most, if not in all, of the species.

"The species *bulbosus* has *compound leaves, an erect, many-flowered stem, a furrowed peduncle, reflexed calyx, and bulbous root.* It grows generally in dry pastures, mowing lands, and road sides, flowering abundantly in May and the first part of June; after which it gives place to its equally abundant successors, *R. acris* and *repens,* which, however, generally prefer a more moist soil. These three species, having flowers of similar size and appearance, are indiscriminately known by the name of *buttercups.* Their distinction affords a pleasing instance of different combinations of features, forming separate characters for similar plants. The *R. bulbosus* has a furrowed flower-stalk, and reflexed calyx; *R. repens* a furrowed flower-stalk, and spreading calyx; and *R. acris* a round flower-stalk, and spreading calyx.

"The roots of *ranunculus bulbosus* appear to consist principally of albumen intermixed with ligneous fibres. If the root be macerated in cold water, it gives a solution of this substance, which coagulates in flocks, on the application of heat; and undergoes the same process slowly on the addition of alcohol. But the most interesting constituent in this, and in most other species, is *the acrid principle,* which pervades every part of the plant in its green state. Like the *arum* it is volatile, and disappears in drying, or upon the application of heat. It differs, however, in not being destroyed by a moderate heat, and in being fully preserved in distillation. I have subjected various species of ranunculus to this experiment, and always found the distilled water to possess *a strong acrimony;* while the decoction, and the portions of the plants remaining in the retort, were wholly destitute of this property. This distilled water, when first taken into the mouth, excited no particular effect; but after a few seconds a sharp, stinging sensation was always produced. When swallowed, a great sense of heat took place in the stomach. I preserved some of the water, distilled from the leaves of *ranunculus repens,* for several months, in a close-stopped phial, during which time it retained its acrimony undiminished. In winter time it froze, and on thawing had lost this property. Tilebein, as quoted by Dr. Pulteney, in some experiments on this genus of plants, found that water distilled from *R. sceleratus,* on cooling, deposited small crystals, which were hardly soluble in any menstruum, and were of an inflammable nature. I have not met with an appearance of this kind. The distilled water, however, had a substance dissolved in sufficient quantity to yield a gradual precipitate with some reagents, such as muriate of tin and acetate of lead. The strength of the distilled water is impaired by continuing the operation too long. The acrimony of the plant is expended in a very short time at the boiling heat, and a further continuance of the distillation, brings over only water.

"Since the time of Dioscorides, the acrid and stimulating properties of ranunculi have been well known. This acrimony resides in all the species, with the exception of *R. auricomus,* which is said to be mild, and perhaps two or three others. It is so powerful, that it speedily inflames or corrodes the lips and tongue, if kept in contact with them. In the nostrils it acts as a violent sternutatory, and if swallowed in considerable quantity, it brings on great pain, heat, and inflammation of the stomach, and has even occasioned convulsions and death.

"Before the introduction of cantharides as a vesicatory, different species of the ranunculus were used upon the skin, as external stimulants. Their power of occasioning erosion and ulceration appears to have been known to the ancients. Different medical writers have given accounts of their mode of operation, but the most extensive history and investigation, is that of Krapf, published at Vienna, in 1766. This work, which I have not seen, is quoted in all its principal facts by Professor Murray of Gottingen, in the "*Apparatus Medicaminum.*" According to this author, the various species, with which his experiments were made, *proved capable of exciting inflammation, blistering, and ulceration,* when applied to the skin. A slice of the fresh root of *R. bulbosus*, placed in contact with the inside of the finger, brought on a sense of burning in two minutes.

"When taken off, the skin was found without redness, and the sense of heat and itching ceased. In two hours, however, it returned again, and in ten hours, a full serous blister was raised. This was followed by an ulcer of bad quality, and difficult to heal. He remarks, that, if the application is continued after the first itching, the pain and subsequent erosion is much greater.

"From the accounts given of this species, also of *R. sceleratus*, *R. acris*, and some others, it appears that the leaves, flowers, buds, or roots of these plants, if bruised and applied to the skin, excite redness and vesication. This effect is not constant, but fails to take place in certain constitutions, or at certain seasons of the year. Generally, however, they are said to possess the advantage over blisters made by flies, that they never occasion symptoms of strangury.

"An objection against the use of the ranunculi, as external stimulants, exists in the uncertainty of their operation, and the violent effects which sometimes have followed, after they had been applied. Those writers who have witnessed their application, record instances in which these vegetable blisters have been followed by deep, ill-conditioned, and sloughing ulcers, which were not healed without great difficulty. Tissot mentions an instance, in which an application made to the thumb caused a deep and painful ulcer, which penetrated to the bone, and occupied some months in its cure. In another case, the blister spread in a few hours over the whole arm, occasioning fever and delirium, and was followed by such a tendency to gangrene, that the limb was with difficulty saved. Chesnau, quoted by Murray, advises that the ranunculus should be applied to a small surface only, and through a perforation in an adhesive plaister, to prevent it from spreading. From want of this caution, he has known extensive inflammation to arise, and spread over a great part of the face, neck, and breast. Linnœus, in his *Flora Suecia*, relates that beggars, in Sweden, were known to excite ulcerations of their feet, with the *ranunculus sceleratus*, to assist them in extorting charity from passengers.

"I know not to what extent the efficacy of the ranunculi, externally applied, can be depended on. Certain it is, that they do not affect all persons alike; and this fact is avowed by those who have used them most.

"The burning sensation, which the ranunculi excite in the mouth, when chewed, extends to the stomach, if they are swallowed. Krapf states, that a small portion of a leaf or flower of *R. sceleratus*, or two drops of the juice, excited acute pain in the stomach, and a sense of inflammation in the throat. He gave a large quantity of the juice to a dog, which brought on vomiting, and great distress; and the animal being killed, was found with the stomach inflamed and contracted, and the pylorus hardly pervious.

"Grazing cattle generally avoid the plants of this genus, which grow among grass, as far as it is possible for them to do it. Accordingly we observe the flowers of the ranunculi left untouched, while the grass is closely cropped around them. It is nevertheless unavoidable, so common are these plants, that portions of them should be eaten very often by these animals."

LII.—*On a Plantation of Cloves, in the Colony of Trinidad.* By M. Francis le Cadre*.

Sir, *Trinidad, May* 12, 1824.

An advertisement having appeared in the gazette of this Island, stating certain premiums offered by the Society for the encouragement of Arts, Manufactures and Commerce, and particularly some for the advantage of British colonies, as follows,—" To the person who shall grow the greatest quantity of merchantable cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, and equal to those imported from the islands of the East Indies;—the *Gold Medal, or Fifty Guineas*. Satisfactory certificates from the governor or commander-in-chief of the place of growth, with an account of the number of trees, their age, and nearly the quantity of fruit on each tree, and the manner of culture; together with samples, to be produced on or before the first Tuesday in January, 1825:"

And having made, a few years past, some plantations of that description upon my estate here, I have the honour to address to you, as secretary of the said society, the certificates from the governor of this island, as required; and also of sending twenty pounds weight of cloves, the growth of the said estate (conformably to the said advertisement), to William Vaughan, Esq., with the bills of lading. I am, sir, &c.

A. Aikin, *Esq. Secretary, &c. &c.* Fs. le Cadre.

CERTIFICATES.

Trinidad.—By his Excellency Sir Ralph James Woodford, Bart. Governor and Commander in Chief, in and over the said Island and its dependencies, &c.

Ralph James Woodford.—This is to certify to all whom

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The Society voted its premium of fifty guineas to M. le Cadre.

it may concern, that Francis le Cadre, Esq. is a resident planter of this island, and that Edmonstone Hodgkinson, Esq. is commissary of population, and acting surveyor-general.

Given under my hand and seal of office, at Government House, in Port of Spain, this 6th day of May, in the year 1824.

FREDERICK HAMMET, *Assist. Sec.*

SIR, *Trinidad, March 17, 1824.*

Having observed that *the Society for the encouragement of Arts* has offered premiums for the cultivation of cloves and cinnamon in the West Indies, agreeably to an advertisement, as follows:—"To the person who shall grow the greatest quantity of cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, equal to those imported from the islands of the East Indies;—*the Gold Medal, or Fifty Guineas*. Satisfactory certificates from the governor of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday of January, 1825."

I beg leave to address your excellency on the subject, and to lay before you the enclosed statement, in the hope that your excellency, after having ordered the examination of my spice plantations, will be pleased to grant to me the certificates required by the society, so as to enable me to make application for the premiums offered.

I have the honour to be, &c. &c.

FRANCIS LE CADRE.

To His Excellency Sir Ralph Woodford, Bart.
Governor, and Commander in Chief, &c.

The commissary of population is directed to make the examination requested, taking to assist him Mr. E. Davis, assistant-gardener of the colony, (in the absence of Mr. D. Lockhart), and Mr. J. Wilson, gardener to the Cabildo.

RALPH WOODFORD, *Governor.*

Trinidad, March 17, 1824.

Statement of certain spice plantations made by, and belonging to, the subscriber, a planter in the quarter of Diego Martin, in the said island of Trinidad, drawn up for the purpose of applying to the Society for the encouragement of Arts, for the premiums offered as follows:

"To the person who shall grow the greatest quantity of cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, equal to those imported from the islands of the East Indies;—*the Gold Medal, or Fifty Guineas.* Satisfactory certificates from the governor of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday of January, 1825."

CLOVES.—One hundred and nine trees, nine years growth, fifteen inches in circumference.

Average produce of each tree, two pounds dried, which is the result of six pounds green.

And large nurseries of young plants from one to six and a half feet high.

This plantation having been commenced with no other view than the disposal of its produce in this island, was not planted with the regularity observed in the East Indies, cinnamon trees having been intermixed at five feet distance, with the clove, and the former being much larger than the latter, of course their growth was checked, and the produce lessened: but as this species of culture is now encouraged in the mother country, with views no doubt advantageous to the planter, the mode of planting pursued in the Moluccas will be adopted in this part of his majesty's dominions.

CINNAMON.—One thousand trees, nine years growth, and large nurseries of young plants.

The former are planted as the clove trees, they are thirty-six inches in circumference, but they grow larger when planted separately, the subscriber having a few above forty inches in girth.

The cinnamon is thicker than that from Ceylon, but that which is made from the sprouts of the trees after they have been cut down at twelve or fifteeen inches from the ground, is much thinner, and of a superior quality, as the subscriber has been convinced of, from a few trees he cut down about four years past; so that he has no doubt that the Trinidad cinnamon will be soon much improved.

The cinnamon now in this island is the produce of six young trees imported; three from the botanical garden of Martinico, and three from that of St. Vincent, sent to Governor Picton, as Ceylon cinnamon. Several thousand pounds weight of it have been already imported from Trinidad, and a few days past 3018 pounds weight were shipped for Gibraltar, for consumption in the Mediterranean.

The subscriber, agreeably to the advertisement of the Society for the encouragement of Arts, sends twenty pounds of his clove, and an equal quantity of cinnamon, in the hope that the Society will give him the premiums offered.

F. LE CADRE.

Trinidad, Commissary of Population's Office,
April 14, 1824.

SIR,

In obedience to your excellency's commands upon the application of M. le Cadre, concerning the premium offered by the Society of Arts in London, for the cultivation of cinnamon and cloves in these parts of his majesty's dominions, I have the honour to report to your excellency that I repaired to the plantation of that gentleman, situated in the quarter of Diego Martin, accompanied by the colonial gardener and the gardener of the Board of Cabildo, and having particularly examined the same, we respectfully submit the following observations.

There are 109 clove trees in bearing, and upwards of 1000 cinnamon trees, with large nurseries of both, particularly of the former; those which are in bearing are about nine years old; they are both hard woods.

The clove almost produces its own nurseries, as the seeds take root merely by falling on the ground; if planted deeper it will perish. The clove at all times requires some, but while young it needs a very thick natural shade. M. le Cadre frequently tried artificial shade, but the seedlings always died under it. The plant is altogether the most delicate and difficult to raise that is known in this country. When ground is destined for the nursery, it should be carefully prepared by freeing it of roots and stones, and the bed should be raised a few inches to prevent the rains from washing away the earth from the roots of the young plants.

The transplantation may take place when the seedling is about nine months old, and about a foot or eighteen inches high; those I speak of are about ten feet asunder, having a cinnamon tree between each, and shaded, as the cocoa is with bois-immortel.

The cloves at M. le Cadre's having been partly planted on flat, and partly on rising ground, afford a strong proof that the latter situation best suits the plant, probably from its superior dryness, and the quick drainage of the rain water. The two plantations are not distant from each other; the soil is the same, about three parts strong loam and one part sand. The shade on the low land is closer, those on the hill are rather exposed to a northern aspect, not the most favourable in this country; the trees are all of the same age, about nine years, and yet the latter are nearly a fourth larger than the former, besides having foliage of a deeper green hue, and possessing altogether a more healthy appearance, being about twenty inches in girth at six feet from the ground, while those growing on the low land are about fifteen to sixteen inches round at the same height; they are about twenty feet high. Manure has not been used to any part of this plantation, nor would it perhaps be advantageous at any time, on the generality of soil in this new country, where, having been good when first put in cultivation, it is preserved from wearing out by the shade and the droppings of the leaves.

From what is above observed it is evident that the clove thrives best in dry soil, and requires little more moisture than its shade furnishes and keeps up. For transplantation, in common with other plants, a moist season should be chosen; and of aspects, it is well known that in this country all vegetation thrives best upon that which is to the westward, and is sheltered from the trade wind.

Those clove-trees began to bear at seven years of age, and produced the fruit in the month of February: it is picked in the month of March; but any left for seed remains, and continues to grow till the month of June, when it has greatly increased in size, and falls off ripe. It is so very delicete a grain that it should be sown as soon as possible, and not later than thirty-six hours after separation from the tree.

The produce of those trees is now about six pounds of green cloves, which dry up to about two pounds of merchantable cloves per tree per annum; but the quantity of fruit would probably be greater were it not for the closeness of the cinnamon tree, which likewise, by causing it to grow tall, puts much of the fruit out of sight, and renders the gathering difficult; that which is beyond the hand is snapped off in the cleft of a long stick.

I am unacquainted with the treatment of this plant in the Spice Islands, but from comparison with the cultivation of others under our daily inspection, as cocoa, coffee, &c. it does not appear that those here are under the most judicious system of propagation; in all countries we observe fruits are so trained as to grow as little as possible beyond the reach of the hand, and except in the greater degree of delicacy in the clove plant, it is highly probable its cultivation could be very much assimilated to that of coffee, which, when its vertical growth is checked, extends horizontally, and is in every part within reach for any purpose.

This remark cannot be applied to M. le Cadre, who had not the advantage of any precedent to guide his exertions, who, in the perseverance which was requisite in saving 109 out of about 4000 plants, has accomplished a very important colonial object, and one which may be a leading feature in its future history.

I have the honour to be, sir, yours, &c.

EDMONSTONE HODGKINSON.

Commissary of Population, Acting Surveyor-General.

His Excellency the Governor, &c. &c. &c.

The committee of Colonies and Trade having requested the opinions of dealers in spices, and of others conversant with the article, on the samples sent by M. le Cadre, were favoured with the following letters from Messrs. Tucker and Hunter, spice-brokers, and Mr Jarman, warehouse-keeper of spices to the East India Company.

DEAR SIR, *39, Lime-street, March* 11, 1825.

The cloves, of which you sent us a sample, are very fine. We do not hesitate to say that they are superior to Bourbon, and, indeed, equal to Amboyna cloves in flavour, and nearly so in size. We have had many parcels through our hands of a similar description, the produce of Cayenne.

We never before saw a sample of cloves, the growth of a British colony in the West Indies; but from the specimens now sent, we think that every encouragement ought to be held out for their extensive cultivation.

We are, sir, yours, &c.

TUCKER and HUNTER.

CHARLES COPELAND, *Esq.*
8, James-street, Adelphi.

MY DEAR SIR, *Leadenhall-street, April* 12, 1825.

The cloves you sent for my inspection are very fine.

They are not so large nor so strong in flavour as Amboyna cloves (the best sort known), but are superior to the Bourbon clove, of which considerable quantities are annually sold in London. I am, sir, &c.

W. Evans, Esq. Wm. Jarman.

Chairman of the Committee of Colonies and Trade.

LIII.—*On an excellent Swiss half-round Drill.* *By the* Editor.

WITH FIGURES.

M. Lariviere, to whom the Editor is indebted for the sight of the improved mode of using forge-bellows, inserted in the present number, has continual occasion to make numerous cylindrical holes through blocks and plates of steel, in the construction of his patent machines for perforating metal plates, to serve as sieves, wine-strainers, filtres for tea and coffee-pots, substitutes for the wire gauze used in safety-lamps for mines, lanterns for gunpowder-works, stable lanterns, &c., and some of which plates are pierced with holes so very small, as to be nearly invisible to the naked eye, although, when held against the light, they appear nearly as transparent as fine lawn or cambric! These holes are all made by means of cylindrical *punches*, made of steel wire, hardened and tempered, and accurately fitted into cylindrical holes, made in proper steel plates to retain them firmly; and they act in other tapering holes formed in hardened and tempered steel blocks, plates, or *beds*, to correspond with the punches; and, in fact, *the smallest holes are made with drills as fine as the human hair!*

These small cylindrical holes, made through blocks or plates of steel of considerable thickness, require, of course, drills of a very superior description to perforate them; and accordingly we were much gratified by the kindness of M. Lariviere, in enabling us to publish a description of them.

These drills are made of the best cast-steel wire: their stems are cylindrical, but their acting parts are semi-cylindrical, with points formed of two planes, meeting at an obtuse angle. In plate XII. fig. 3 represents one of the larger-sized drills, viewed in front; fig. 4, a back view of it; fig. 5, a side view; and fig 6, and end view, taken at the dotted line in fig. 4. They thus constitute a sort of *half-round boring-bit,* so valuable in many of our nice mechanical operations, but with a differently formed end; the ordinary half-round bit being sloped off at its end in one plane, or rather portion of a spiral, instead of in two, as here shown. Sometimes, however, their ends are sloped off in a rounding manner, as shown in figs. 7 and 8; this is done when the drills are required to open holes only, and not to drill them from the beginning.

These drills are readily formed, and when carefully hardened and tempered, are easily kept in order, by whetting their points with a turkey oilstone, their size not being altered thereby, as in the usual drills, and which is indeed a very great recommendation in their favour.

These drills are generally used in lathes, formed of the common *Geneva turns,* by the addition of a small mandrel, with a conical end to it, which turns in a conical collar, mounted upon a sliding block, secured upon the main-bar of the turn; the other end of the mandrel having a central hole, which is applied upon the conical end of one of the sliding cylinders of the turn. A pulley upon the mandrel receives motion from the lathe-wheel. Instead of screwed chucks being made to screw upon or into the mandrel, it is provided with a square hole at its mouth, into which the square stems of the different apparatus to be applied to it are accurately fitted, and they are secured therein by a binding screw in the mandrel, which inters a notch or gap formed in one of the angular edges of each square stem. Into these substitutes for the usual chucks the half-round drills are fitted, by cylindrical holes being drilled in their centres, whilst in their place in the mandrel, to suit the various sizes of the stems of the drills, and which are held securely therein by means of screws. Sometimes, one of these substitutes for chucks is made to receive differently-sized drills, in the following manner:—In fig. 9 is shown one of them, but instead of holding a drill it contains a steel cylinder, perforated with a cylindrical hole, and also furnished with a binding screw; into this cylindrical hole the stems of smaller sized drills can thus be fitted, and be securely held; or instead of a drill, it may also receive another steel cylinder, with a still smaller cylindrical hole in it, and another binding-screw, and thus serve to hold the yet more diminutive drills. Figs. 10, 11, and 12, represent drills of three different sizes; but drills of any size between them may easily be fitted into these carriers, either by reducing their stems or their working parts as may be required.

LIV.—*On Cloth made in England, from New Zealand Flax. By Mr.* R. Jones, *master of St. George's workhouse, Little Chelsea**.

SIR, *St. George's Workhouse, Little Chelsea, Feb. 5, 1825.*

I HAVE herewith sent you a specimen of seven-eighths twilled drill for trowsers, also of nine-eighths sheeting, made by order of Mr. Wilson, from New Zealand flax obtained by that gentleman from the Colonial Office. As I presume it may show to what use that article may be turned in the manufactures of this country, and as it is now become a subject of public enquiry, I take the liberty of sending the accompanying samples, in order that you may submit the same to the consideration of the Society for the encouragement of Arts, Manufactures, and Commerce, should it be worth their notice.

I am, sir, &c.

R. JONES.

A. Aikin, Esq.
Secretary, &c. &c.

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The society voted its silver Ceres medal to Mr. Jones.

P.S. The pieces from which the specimens were taken were spun and woven by pauper children, under my inspection, in this establishment.

The candidate further stated before the committee, that the raw fibre was boiled in alkaline lye, and subjected to the usual bleaching operations of flax or hemp. The cloth was soft to the feel, of a good colour, and seemed likely to prove very durable, furnishing an additional motive to the landholders in the south of England, and especially in Ireland, to make a fair experiment on the culture of New Zealand flax, a plant which produces a greater quantity of fibre than any other vegetable.

LV.—*On the Cementation and Fusion of the Thermo-Lamp Steel. By Professor* G. Vismara.*

It was Professor Vismara, who first invented the cementing of iron, or the conversion of it into steel, by carburetted hydrogen gas. He obtained steel by this means which possessed excellent qualities: the following are the results of ninety-nine experiments.

His apparatus consisted of a reverbatory furnace, heated by wood, in which was placed a vessel formed of wrought-iron, and supported upon two iron bars. In this vessel was placed, the iron intended to be cemented; and with that view he made the gas, obtained by distilling fat in a cylinder heated red-hot, to pass through it, and which gas was finally conducted into a gasometer.

The temperature was generally kept at 54° by Wedgwood's pyrometer, and rarely exceeded 60°.

In one experiment, he placed in the vessel 66 lb. of hard iron from Bergami, intended for the tires of carriage wheels, in pieces of about two inches wide, and two or three lines in thickness; six lb. of Carinthian steel, in bars four lines square; and two lb. of soft iron, from Dongo; in the whole, seventy-four lb. of iron and steel; and, in

* From the *Giorn. di Fisica, &c.*

order to prove the difference between this new method, and the English process, he put into a crucible, and inclosed with powdered charcoal, six small pieces of hard iron, similar to that abovementioned, as being placed in the iron vessel,

The first day the fire was kept up for nine hours, and the heat carried to 60° of Wedgwood, during which time two lb. six ounces of fat were introduced into the red-hot cylinder. On the second day the fire was continued for six hours to 64° of Wedgewood, and six pounds of fat were employed. On the third day the iron, &c. were heated for six hours to 64°, and about three pounds of fat were used. In the whole the apparatus was exposed to heat for twenty-one hours, and twelve pounds of hogs' lard were employed.

The hard iron from Bergami was completely cemented, and indeed some parts of it presented the appearance of a fusion having commenced.

The soft iron from Dongo showed in its fracture some white and brilliant points; it was not, however, completely cemented, and ten hours more would have been requisite to have perfected it.

The Carinthian steel afforded a fine grain, and was possessed of both hardness and toughness.

The iron heated with charcoal powder, was indeed cemented, but much less so than that which had been treated by the gas. The hard steel produced from the iron of Bergami, afforded, when forged, a coarse grain, brilliant and equal in all parts; it broke easily with a single blow, and was singularly and exceedingly sonorous: when hardened, it afforded an ash coloured grain; and, on being tempered, it was still sufficiently hard: its grain was exceedingly close, and it possessed great strength and toughness. He caused it to be made into scalpels, files, knives, scissars and pen-knives; and, lastly, into razors, which proved good on trial; but both the razors and scissars were unpleasant to the eye, their surfaces being covered with threads and spots. The very small and delicate instruments however, which were made of the *thermo-lamp* steel, after having been well fused, and cemented anew, for twelve hours more, took an uniform and fine polish. Knives, razors, &c. were made of this *thermo-lamp* steel, and proved equally good with those made of the best steel; as did also gravers, medal dies, gardeners' shears, and sculptors' chisels.

The other steels, cemented at this experiment, were also of good quality.

Professor Vismàra has given the specific gravities of nine specimens of steel; but he observes, that the weight varied in different parts of the same bar.

He has also, as above-mentioned, made experiments on making *thermo-lamp* cast-steel. And here he could not avoid observing the singular irregularities which Wedgwood's pyrometer presented, when employed to measure the heights of the temperatures. The pyrometric pieces showed different temperatures, when they were placed at the bottoms of the crucibles, upon the melted matters, or upon their exterior. The following are the general results of the materials he employed in fusing his steel:—with bottle-glass, containing no lead, the steel was perfectly fused at a temperature of 100° of Wedgwood; with lime, and other earthy substances, it became in full fusion at 90°; but with either of the two fluxes the point of fusion was very sensibly lowered, on adding two or three per cent. of charcoal powder or lamp-black.

The *thermo-lamp* steel, fused with a flux of glass, was cast into ingots of from 24 to 34 inches in length, and 10 lines square; when forged, they were of a white grain, exceedingly sonorous, easily broken by a blow, and presented a fracture of a brilliant grain, and perfectly equal. They were drawn into bars of about two lines square; but required to be heated and hammered with great care, for if they were either too much or too little heated they broke under the hammer. In first beginning to forge them, the blows must be well regulated, and always be made to fall flat, the bars being frequently heated anew; and this treatment must be continued until the parts of the metal begin to unite, when it will yield more readily and obey. English *Huntsman's cast-steel* presents the same characters. To forge the bars of *thermo-lamp* steel into instruments, they must be gently beaten, and be frequently heated; but if they resist the hammer too much, they must be *decarbonated* a little, by heating them to redness in a crucible, surrounded with powdered quick-lime. To obtain a very malleable steel, it is sufficient to withdraw the crucible from the fire, when the steel has acquired a pasty consistence.

The steel fused with earthy fluxes has properties very different from that which has been fused with glass; it presents a lamellated fracture, resembling that of antimony; it is of an ash colour, and is easily broken by the slightest blow; it resists the hammer a little when it is worked hot, but it easily cracks, and indeed it is difficult to find a bar free from flaws or cracks. When plunged into acids, it affords a fine damasque. All the cast-steels fused with earthy fluxes afforded the professor the same results.

The fluxes he employed were, for the vitreous flux, one-fourth of the weight of the steel to be fused of pulverised common glass, and one-hundredth part of lamp-black. For the earthy fluxes, lime slaked in the air one-fourth, caustic lime one-fourth, and powdered charcoal one twenty-fourth; or powdered quartz one-fourth, quicklime one-fourth, baked clay one-half, powdered charcoal one thirty-second; used in the proportion of one-fourth of the steel to be fused.

LVI. *On the Culture of Vegetables.* By JOHN CHRISTIAN CURWEN, Esq. *of Workington Hall, Cumberland**.

SIR, *Ibbetson's Hotel, London, April 21, 1801.*

I AM fearful you should suppose that I am become indolent, and that the favours so liberally bestowed on me by the society, had ceased to operate as a stimulus to the further exertions of my humble endeavours to assist those objects which, by the fostering hand of the society, have been so essentially promoted. You will excuse me for wishing to assure you that I am not idle, and to inform you that the objects which at present employ me are, I conceive, of great importance to agriculture.

The first is by experiment to ascertain the best and most productive mode of applying manure. The second is to determine whether the distances between the stitches in drill husbandry may not be greatly enlarged, without any diminution of crop.

I am strongly inclined to believe that where the ground is laid dry, that manure can scarcely be deposited too deep; by so doing the evaporation is retarded, and consequently the manure continues for a greater length of time to furnish nourishment to the crop.

The increase of the distances between the stitches permits the power of continuing the operations of turning up the soil to a more extended period, which not only improves the tilth, but furnishes a greater degree of moisture by exhalation, than can be yielded from ground in that state of hardness it soon acquires when undisturbed in summer. This evaporation is prodigious, though not perceptible to the eye: it is, however, fully demonstrated by a very ingenious experiment of the Bishop of Llandaff; and I am anxiously expecting to form such conclusions

* From the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce. The society voted its gold medal to Mr. Curwen for this valuable communication.

from trials I am engaged in respecting its effects on vegetation, as may deserve the consideration of the society.

My former objects of feeding cattle with potatoes, supplying milk to the poor, &c. are pursued with increased success. The use of potatoes as a food for horses and cattle increases daily.

I am, dear sir,

Your faithful and obedient servant,

To CHARLES TAYLOR, *Esq. Sec.* J. C. CURWEN.

DEAR SIR, *Workington Hall, Jan.* 9, 1808.

It is with great satisfaction that I have the honour of again submitting the result of my farming operations to the consideration of the Society of Arts. Deeply impressed with a sense of the many favours conferred upon me by them, I have found myself impelled, both by gratitude and inclination, to proceed with redoubled exertion, as the best return in my power.

The liberal patronage and encouragement bestowed on agriculture by the society, has powerfully contributed to awaken the country to a just estimation of its importance, as the basis of individual happiness and national prosperity; and at this moment the empire owes its preservation and security to it.

I submit with great deference the result of my recent operations. I am disposed to flatter myself that they may lead to important consequences and discoveries, highly beneficial to agriculture. The experiments I have made tend to establish the double advantage of well cleaning and working the ground. First, as it frees the land from weeds; and secondly, as it conduces to the growth of the crop. It affords likewise a very strong demonstration in favour of using manure in its freshest state, by which not only the great usual expense of making dunghills will be saved, but the manure made to extend to the improvement of a third more land.

Most of the farm I occupy was in that state of foulness, as to require, according to general practice and opinion, a succession of fallows to clean it. Being unwilling to adopt a system which was attended with such loss, I determined to attempt to clean a part of it by green crops, and for such purpose to allow a much greater distance between the stitches than had ever been in practice. My first experiment on this plan was made on a crop of cabbages; they were planted in a quincunx form, allowing four feet and a half between each plant, in order to allow room for the plough to work in all directions. I adopted this plan of field husbandry, as affording the greatest facility in cleaning the crop, though I believe it never was before so practised. Two thousand three hundred and fifty plants were set per acre (eight thousand is not unusual in the common method), and each plant had, by computation, an allowance of a stone of manure, or less than fourteen tons per acre; though the common quantity is generally from thirty to forty tons per acre. The manure was deposited as deep as the plough could penetrate, drawn by four horses, and the plant set directly above it.

The plough and harrow constructed to work betwixt the rows, were constantly employed during the summer, and the ground was as completely freed from weeds as it could have been by a naked fallow. The very surprising weight of my crop, which in October was thirty-five tons and a half per acre, and many of the cabbages fifty-five pounds each, were matters of surprise to all who saw them, as well as to me, and I could assign no satisfactory reason for the fact. The quality of the land was very indifferent, being a poor cold clay,—the manure was very deficient, of the usual quantity,—the plants, when set, by no means good,—in short there was nothing to justify the expectation of even a tolerable crop. I did not find any thing in the accounts from cultivators of cabbages to afford me a solution of my difficulties, or any clue to explain it. By mere accident I met with the Bishop of Landaff's experiment, ascertaining the great evaporation from the earth, as related in his admirable Treatise on Chemistry: singular as it may appear, this very interesting experiment had remained for thirty years without any practical inferences being drawn from it applicable to agriculture. It appeared to me highly probable, that the rapid advance in growth made after the hoeing of drilled grain, was attributable to the absorption of the evaporation produced from the earth, and was the cause of the growth of my cabbages. With great impatience and anxiety, as I had the honour to inform you last year, I looked forward to the ensuing season to afford me an opportunity of continuing my experiments. I had long been a strenuous advocate for deep burying of manure, though my sentiments rested chiefly on opinion; this appeared to open a field for incontestible proofs of its advantage. My cabbages were last year planted on the same plan as the former year. Fortunately I extended the same principle to my potatoes, which I was obliged to set on wet strong ground, from want of a choice of land. My annual quantity of potatoe ground is from sixty to seventy acres. They were set in beds three feet long and two feet broad, leaving four feet and a half between each bed lengthways, and three feet endways. On each acre there were 1230 beds, and 6150 sets, or five to each bed, viz. one at each corner, and one in the middle. The sets of potatoes, when planted according to the usual most approved practice, in three feet stitches, and nine inches apart, amount to about twenty thousand. In the present, and indeed in all seasons when potatoes are scarce, the saving in planting is a considerable object. A great advantage also arises in being able to keep the potatoes and manure from wet. In the late uncommonly wet season I sustained little or no loss in my mode, which was not the case in many of the driest grounds. This plan unites hand hoeing with horse culture, and will be found serviceable in wet soils.

The lateness of planting, together with the premature frosts, prevented my forming a fair judgment as to the quantity per acre which might be obtained by this method.

My view in fixing upon this plan was, to enable me to judge of the effects of evaporation, by being able to continue my operations for a longer period. I have no doubt but that in common seasons, notwithstanding the increased distance, the whole ground would be covered.

My experiments on cabbages this season commenced by planting them early in April. From the rain which fell subsequently, and continued till the beginning of May, succeeded by severe east winds, the earth became so hard and baked, that the plants had made very little progress.

In the first week in June the ploughs were set to work: as they started Mr. Ponsonby of Hail Hall was present, and saw the crop; it was with difficulty that the ground was first broken, but by the end of the week it was brought into fine tilth. Notwithstanding the whole week had been dry, with a strong sun and severe east wind, yet such was the progress in growth of the cabbages, that when seen again by that gentleman on the Saturday, he could scarce be persuaded they were the same plants.

During these operations I had been making constant experiments with glasses, contrived for the purpose, to ascertain the quantity of evaporation from the land, which I found to amount, on the fresh ploughed ground, to nine hundred and fifty pounds per hour on the surface of a statute acre, whilst on the ground unbroken, though the glass stood repeatedly for two hours at a time, there was not the least cloud upon it, which proved that no moisture then arose from the earth.

The evaporation from the ploughed land was found to decrease rapidly after the first and second day, and ceased after five or six days, depending on the wind and sun. These experiments were carried on for many months. After July the evaporation decreased, which proves that though the heat of the atmosphere be equal, the air is not so dense. The evaporation, after the most abundant rains, was not advanced beyond what the earth afforded on being fresh turned up. The rapid growth of my potatoes cerresponded perfectly with the previous experiments; and their growth in dry weather visibly exceeded that of other crops where the earth was not stirred. The component parts of the matter evaporated remain yet to be ascertained; the beneficial effects arising from it to vegetation cannot be doubted or denied, but whether they proceed from one or more causes, is a question of much curiosity and importance.

May not a similar process here take place, as when water is exposed to the action of the air in irrigation? Is it too much to suppose some natural operation to take place in the earth, which may decompose the oxygen contained in air from the hydrogen, during the absence of the sun, which on the sun's re-appearance may be again given out in a state highly propitious to vegetation? Oxygen is found to contain carbon; and may not the growing plants imbibe it from the air, and may we not thereby account for its forming a constituent part of all vegetables.

The investigation of these objects presents a wide field for inquiry, and may lead to very important discoveries. From more or less oxygen contained in the earth, may not its proportions account for the fertility of one soil above another; may not the advantages supposed to be derived from loosening the soil, proceed from its being thus rendered in a fit state to imbibe the air? Fallows soon become so hard upon the surface, as neither to be capable of absorption or evaporation. One very important result is placed before the eyes, and within the reach of every practical agriculturist to ascertain, namely, that the evaporation from dung is five times as much as from earth, and is equal on the surface of an acre to 5000 pounds per hour. By making use of dung in its freshest state, the farmer may extend his cropping to one third more land with the same quantity of manure. It is with regret that I have viewed in many parts of the kingdom the quantity of manure which is exposed to the surface, and tends to no good. I am strongly of opinion that in all light soils, if the manure was buried in trenches as I propose, and the turnips sowed above it, that more abundant crops would be procured. By cleaning with the plough, great advantage would be derived to the crop, from the evaporation yielded by the earth. Hot manure might also be used. By fermentation dung is reduced to one half its bulk, and its quality reduced in a much greater proportion. The manure now commonly taken for one acre of broad cast, would, if deposited whilst hot in drills, answer for four acres, and the crop produced be much more.

If the Society of Arts extend their sanction and patronage to my exertions, I shall feel bound to proceed, and to endeavour to bring the experiments to a regular system. The glasses I used for determining the quantity of evaporation were of a bell form, and placed with the open part upon the earth; a quantity of tow was first weighed, ready to wipe off the moisture collected from evaporation within the glass, which tow was then again weighed as exactly as I could, after the glass had stood for a given time, and been wiped dry with the tow; and from knowing the contents of the glass I made my calculations. Mr. Robert Wood, watch-maker, of Workington, attended to the experiments made with the glasses.

I have the honour to be, &c.

To C. Taylor, M.D. *Sec.* J. C. Curwen.

SIR, *Ibbetson's Hotel, Vere-street, April* 8, 1808.

It is with great pleasure and satisfaction that I learnt yesterday from Mr. Arthur Young, the secretary of the Board of Agriculture, that he has adopted my idea of the great importance of evaporation, and that he has actually ordered Mr. Blunt, optician, of Cornhill, to construct him an instrument for ascertaining the evaporation, which instrument I shall request Mr. Blunt to show to the society. Mr. Young, intends in the course of the summer to make variety of experiments on the quantity of evaporation produced from different soils, agreeing with me, that the greater or less degree of it influences most materially the luxuriance or growth of the crop.

In all the valuable tracts which Mr. Young has given to the world he has never adverted to this; and the first knowledge of it, as a principle for promoting the growth of crops, was obtained from my account of the Schoose farm, in the report of the Workington Agricultural Society, of which he is a member.

Being unable to account for the surprising weight of my first crop of cabbages, with only one-third of the manure usually given, I was led to make the experiments I have laid before the society; and I believe I am not only the first person in Lancashire, but even in Great Britain, who ever thought of ploughing the ground upon the principle I have executed, for promoting the growth of the crops. I flatter myself that my experiments on the economical application of manure, will lead in a high degree to facilitate a more extended cultivation, and obviate the objections which have been started by some persons against the inclosure of waste lands, from their supposition that manure could not be furnished for more than the land at present cultivated.

I remain, dear sir, your obedient servant,

To C. TAYLOR, M.D. *Sec.* J. C. CURWEN.

CERTIFICATES.

A certificate from Miles Ponsonby, Esq. of Hail Hall, testified that he had seen Mr. Curwen's statement of the rapid progress made by his cabbages in the month of June 1807; that he perfectly recollects viewing them on the Monday, and again on Saturday in the same week; that the improvement in the appearance of the plants was so great, that he imagined the land had been replanted, till Mr. Curwen explained the cause which had produced so great a change. That he considers Mr. Curwen's plan of managing his potatoes and cabbages as very good garden husbandry, and the best calculated for keeping the land clean, improving the plant, and at the same time enriching the ground, of any that he had observed; and though the mode is entirely new there, he has no doubt but it will be found beneficial, and that it will in a few years be much attended to.

A certificate from Mr. D. Campbell, secretary to the Kendal Agricultural Society, stated, that he had attended to the cultivation of potatoes in most parts of Lancashire, and could speak with the greatest precision respecting it in that part of the country, which is north of Lancaster. That whether they were planted in the lazybed way, by the dibble, or with the plough, they were always set in *rows* from *one end of a field,* or *piece of ground,* to *the other end or side,* with narrower or wider intervals, as the cultivator might deem best suited to the kind of potatoe he was raising. That he never before saw or heard of their being cultivated in beds, in the manner practised and described by Mr. Curwen, and that being more particularly desirous to ascertain whether any such method was pursued in the great potatoe district which lies south-west from Lancaster, including Pilling, the Filde, Rufford, and the neighbourhood of Preston, he applied to George Clayton, Esq. of Lostock Hall, and Robert Hesketh, Esq. of Warrington Hall, gentlemen upon whose accuracy the utmost dependance may be placed, and who informed him, that neither from their own knowledge, nor from inquiries they have made, can they learn that the method of cultivating potatoes alluded to, has been seen or heard of in a tract of country, where more are raised for the market than in any other of the same extent perhaps in the kingdom. Mr. Campbell further stated, that Mr. Curwen's cabbages were planted at a much greater distance than any he had ever before seen, and their size far exceeded, as a general crop, any that had fallen under his observation; that the ground was perfectly clear from weeds, and from having been frequently turned over by the plough in the intervals, the mould appeared to be in fine order for a subsequent crop, and he conceived that in the two essential points of freedom from weeds, and of the land being in a fine tilth, no garden could exceed it.

Other certificates respecting the novelty of the method of planting potatoes, as practised by Mr. Curwen, were received from the following gentlemen: William Knott, Summerhill; Mr. Sunderland, Ulverston; J. Penny Marshall, Bolton Oak.

Further certificates, stating the method to be new, as practised by Mr. Curwen, for planting both potatoes and cabbages, were received from the following gentlemen; Walter Gardener, Crooks; William Harrison, Ulverston; A. Benson, Reading; Henry Richmond Gale, Bardsee Hall; Jos. Penny, Budgefield; Edward Barrow, Allithwaite Lodge; Charles Gibson, president of the Lancaster Agricultural Society; Rev. J. Barnes, Pennybridge; Rev. E. Ellerton, Colton; Jos. Yorker, Ulverston; Michael Knott, Thurstonville; Rev. Joseph Brooks, Ulverstone; Thomas Machell, Aynsome.

Also from the following farmers, resident in the neighbourhood of Lancaster: Thomas Tart, William Armstead, William Staller, Anthony Eidsforth, Christopher Atkinson, Robert Edmondson.

DEAR SIR, *Board of Agriculture, May 6, 1808.*

Mr. Curwen having informed me that a question would probably arise in the Society of Arts, &c. relative to the degree of exhalation of water from the earth, and it appearing to me to be intimately connected with various matters in agriculture, I think you will not be displeased, at my mentioning a few circumstances, to prove that the object deserves much attention. I conceive that it bears upon the point of showing the great depth to which dung may be ploughed with safety; for when we find, as I have done, that from two to three thousand gallons of moisture are exhaled in a day from an acre of land, and that the quantity varies greatly according to the state of tillage, it should appear that such a vertical stream of vapour must remove all apprehension of burying dung. I also think it goes to the point of hoeing and horse-hoeing such plants as demand much moisture. I have found that the dung in a farm-yard, laid three feet deep and hard trodden by cattle all the winter, has exhaled in the proportion of about four thousand gallons per acre in ten hours; from hence a practical conclusion may be surely drawn. I could much extend these observations, but they are sufficient to convince so enlightened a mind as yours of the propriety of a very extensive pursuit of this inquiry.

I have the honour to be, &c.

To C. TAYLOR, M.D. *Sec.* ARTHUR YOUNG.

LVII.—*Extract of a Report made by the Committee of Mechanics, in the Society of Arts of Geneva, on a new improvement, made in the Manufacture of Filtres, Strainers, &c. composed of perforated Metal Plates: By* M. MARC LARIVIERE.

(From the *Bibl. Univ.* Dec. 1824.)

WITH A BLOCK PRINT.

October 22, 1824.

"THE commission, directed by the Committee of Mechanics in the Society of Arts of Geneva, to examine the improvements introduced by M. Lariviere in the art of *decoupeur*,* which is carried in this city to a high degree of perfection, and particularly in articles of jewellery; are willing that we should communicate the result of their examination, and afford such an extract from their report, as may merit the attention of such of our readers, who may be interested in these objects; it is indeed a new manufacture, even in this city; so well known for its industry; and its products possess that character of utility, which must confirm the merits of the invention.

* Or the art of cutting out, or piercing holes, &c. in metal plates, by means of beds and punches, in fly-presses, stamps, &c.

"In the year 1823, M. Lariviere presented to the Society of Arts, sheets or leaves of various metals, (but particularly tinned-iron) pierced in the manner of a sieve, with very small and equi-distant holes; and which he stated that he had executed by means of new machines of his invention, which combined the desirable qualities of great expedition, with the most perfect equality in their performance.

"Encouraged by the approbation which his first attempts secured, M. Lariviere endeavoured still more to improve his machines; and he has it now in his power to vary their effects indefinitely, and to apply his improvements to the various presses, stamps, &c. with a superiority of workmanship, and an effect equally prompt and certain.

"In order to give our readers some idea of this species of work, and its results, we recommended M. Lariviere to prepare a block of hard-wood, in which, instead of types, he might insert a number of metal points, corresponding with some of the numbers employed in his system. An impression from this block, which accompanies this extract, will serve to elucidate in some degree, the merits of his invention; but great allowances must be made for the difficulty which the grain of the wood presents, in fixing the points with *that beautiful regularity*, which M. Lariviere has attaiend in his machines.

M. Lariviere has applied his invention to a great variety of purposes, such as filtres, wine-strainers, trellis-work of all forms, fire-guards, sieves to assort the grains of gold employed in jewellery; and safety-lanterns, which admirably answer their design. We saw in the exibition of the Swiss manufactures, at Berne, in July last, an assortment of these works; and which obtained M. Lariviere the honourable and deserved recompense of a gold medal.

"The details, into which the commissaries of the Society of Arts of Geneva have entered, in their report, assist us to comprehend the difficulties which M. Lariviere had to contend with, and add greatly to his merit in overcoming them.

"The set of tools for perforating filtres, (they say), were the results of three years experiment, and continued labour. They are composed of forty pieces, the plates carry 2357 punches; and the number of holes amounts to 6989. Of these plates there are some of an inch in thickness, and which are pierced through with 1132 holes; all these pieces are secured in their places by the aid of two hundred screws.

"We distinguish in the machinery two principal objects, the fly-press and its appendages, and the matrice, and which pierce the holes, and produce the desired effects. The means employed by the inventor to fix, move, and disengage the acting parts, completely fulfil their objects; and the harmony observed in the whole arrangement affords the highest idea of the talents and workmanship of the mechanic. We regret that the just reserve prescribed to us by the interests of the inventor will not permit us to describe his apparatus more minutely.

"We can, however, add, that the tools for piercing the holes in the finest strainers, contain, in one straight line of only 6 inches in length, from 600 to 700 cylindrical holes, of from two forty-eighths to three forty-eighths of a line in diameter, and which holes are intended to receive into them the same numbers of small cylindrical punches, mounted in the form of the teeth of a comb, into a steel plate of that length. Each of these punches performs the office of a cutting-out piece, and if but a single one of them slips out of its place or breaks, the whole system must be arranged anew. It is to be remarked, that to increase the difficulty all the punches must be hardened and tempered. The small round pieces of metal, which they cut out of the holes in the perforated plates, appear to the eye collectively like a fine powder, but when viewed through a magnifying glass they are found to be so many small and perfectly regular cylinders.

"This enterprise of M. Lariviere was certainly a bold one; but the courage and perseverance he has employed in bringing it to perfection have surmounted the difficulties he has had to contend with, and the results are the more honourable to him. The commission can safely affirm, that M. Lariviere is in possession of means which will enable him to carry his art to its utmost limits of perfection. They conclude with recommending, that the committee shall award to him the gold medal of the society."

This recommendation was adopted by the committee.

References to the Figures.

No. 1, is a specimen of an extra-fine perforated metal plate, but the beauty of it suffers, from the unavoidable imperfections of printing.

No. 2, a perforated plate, fit for the strainers of tea-pots.

Nos. 3 and 4, are fit for colanders, or strainers, for jellies, &c. No. 3, with the holes closer together, is fit for miners' safety-lamps.

No. 5, is intended to be substituted in place of wire-gauze, for stable lanterns.

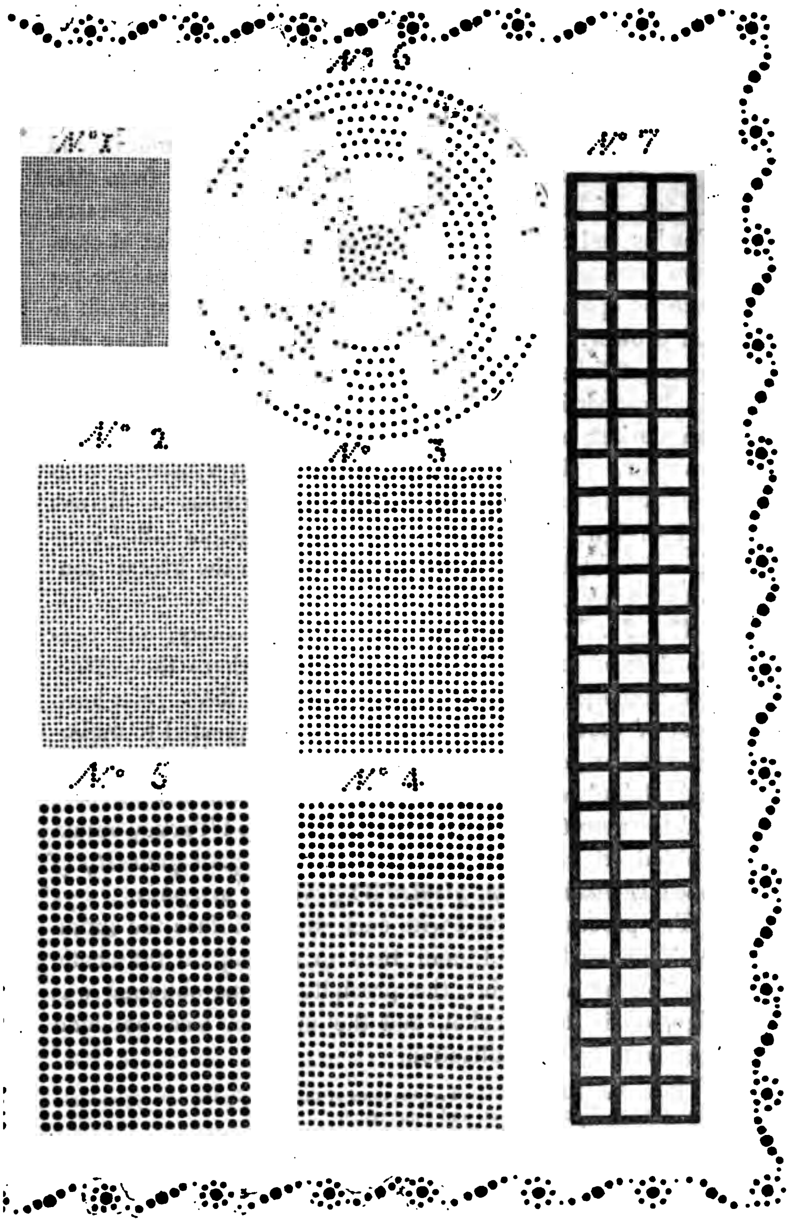
No. 6, is the central part of the filtres for coffee-biggins.

No. 7, is part of a metal plate, perforated with square holes, and is intended to be used by gold-workers, jewelers, &c. for sifting their dust.

Remarks by the EDITOR.

We think that these specimens of perforations furnish an admirable proof of *the very superior properties of the Swiss drills*, described in our present number.

M. Lariviere has very prudently secured the reward of his skill and ingenuity in this country, by patenting his apparatus.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LVIII.—*On the superiority of British Opium to that of Turkey**.

THE Society have for some years offered premiums to encourage the cultivation of the white poppy in this country, for the purpose of obtaining opium from it, and have received communications on the subject from Mr. Young, of Edinburgh, from Mr. Jetson, and from Messrs. Cowley and Staines. From these it appears, that in common seasons, and by proper management, the produce per acre of opium is such as to yield a fair return of profit to the grower. The opinions of professional men have also been published, showing that British opium, in its medicinal properties, is at least as efficacious as the best in the market, namely, that from Turkey. It still remained, however, a desideratum, to ascertain, by a careful comparative experiment, the relative proportions in British and foreign opium, of that vegetable principle called morphia to which the effects of this drug on the human constitution are owing.

Mr. H. Hennell, a member of the Society, and chemical operator at Apothecaries' Hall, where the extraction of morphia from opium forms part of the regular business of that great establishment, was requested to undertake this examination. Opium prepared by Messrs. Cowley and Staines was furnished by the Society for this purpose, and the result was, that 700 grains of dried Turkey opium yielded 48 grains of morphia, and *an equal quantity of dried English opium, yielded* 35 *grains of morphia.*

The process pursued with each was, to infuse the opium in dilute acetic acid, and then to decompose the acetic solution by ammonia: the precipitate thus obtained was digested in hot alcohol, and the morphia was obtained therefrom by crystallization.

* From Vol. XLIII. of the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

LXIX.—*On an excellent portable, botanical, and table Microscope, made expressly for the* EDITOR, *by the late scientific Mr.* SAMUEL VARLEY.

(*Concluded from page* 262.)

THE manner of mounting the lenses in the wheel D, see plate X. fig. 8, is deserving of notice. Five cells are formed in a circle in the outer face of the wheel for their reception, with their sides *undercut*, in the manner of the cells in ivory object sliders, for the reception of the plates of talc; and the lenses are held in the cells in a similar manner to the talcs, namely, by slender springing rings of brass wire. The three larger of the five lenses are perfectly uncovered on their outsides, so as to admit of being readily wiped clean at any time by a piece of soft leather provided on purpose; but the two smaller ones are each nearly covered with a thin brass scale or shell, held in place by springing wire-rings. The apertures in the inner face of the wheel, or that placed next to the eye of the observer, are gradually diminished with the decreasing lengths of the focii of the lenses, so as to cut off the extraneous rays of light, and lessen their aberration, and as shown in the figure, by the faint interior circles in each lens. The lenses can thus be very conveniently removed from their cells, for the purpose of cleaning their inner faces when necessary, although that operation is but seldom called for, as they are generally covered by the flat head upon which the wheel of the lenses is mounted, and are thus defended from dust.

The stage for holding sliders, with objects in them, slips of glass, &c., is affixed to the sliding carriage upon the stem of the microscope, as aforesaid, in the same manner as the forceps, upon the removal of the latter: the stage is composed of an upright brass plate, like the plate S of the forceps, but this plate is extended and bent at top, in a right angle, so as to form a flat and horizontal table of an oval form; it being one inch and three quarters long, and an inch and a quarter wide. In the centre of this oval table a circular aperture, six tenths of an inch in diameter, is made, with an internal ledge or border projecting around its lower part, the twentieth of an inch in breath, to support any thin circular glass plates which may be lodged in the aperture, and which glass plates may be greyed, or slightly roughened, more or less, in order to take away the falseg lare or glitter arising from the suns' rays, the light of a lamp, or candle, &c., when employed to illuminate the objects, and as we have before recommended in our articles on the microscope contained in this work. Close to the upright plate, two springing sockets are firmly affixed into the horizontal plate of the stage, into which sockets are received two cylindrical wire stems, screwed into the inner end of a forked piece of brass, the two forks or branches of which are made thin and elastic, to press upon and hold the ivory sliders, glass slips, tubes, &c., steady upon the stage; when viewing any objects placed between or upon them with the microscope.

The construction of the springing socket, which contains the cylindrical steel wire stem of the forceps, being also peculiar, is deserving of being noticed. It is formed in two similar parts, with a semi-cylindrical groove in each, between which the stem is held; these parts are also extended into two flat circular cheeks, with a hole in the centre of each, and which cheeks are lodged, one on each side of another flat circular plate, with a hole in its centre, which is attached to the stem of the forceps P; a screw, the head of which is a affixed in a flat circular brass plate, is passed through the central holes in the middle plate and the two cheeks, and is screwed into a screwed hole made in another flat circular brass plate; and it thus binds all the five plates, constituting the joint and the two half-holes, together, at any required degree of tightness, and so as to insure the uniform sliding of the stem of the forceps in its socket, to retain the joint steadily, with the assistance of the two other tightening screws, R R, and to place and secure e forceps and object held therein, in any position at pleasure.

LIST OF PATENTS FOR NEW INVENTIONS,
Which have passed the Great Seal since April 22, 1826.

To William Wood, of Summer-hill-grove, in the county of Northumberland, gentleman; for an Apparatus for destroying the Inflammable Air (which is commonly known by the name of Fire-damp) in Mines. Dated April 22, 1826.—To be specified in six months.

To John Petty Gillespie, of Grosvenor-street, in the parish of St. Mary, Newington, in the county of Surrey, gentleman; for a new Spring, or combination of Springs, for the purpose of forming an Elastic Resisting Medium. Dated April 25, 1826.—In six months.

To Samuel Brown, of Eagle Lodge, Old Brompton, in the county of Middlesex, gentleman; for certain improvements on his former patent, dated December 4, 1823, for an Engine, or instrument, for effecting a Vacuum, and thus producing powers by which Water may be raised and Machinery put in motion. Dated April 25, 1826.—In six months.

To Francis Halliday, of Ham, in the county of Surrey, Esq.; for an apparatus or machine for preventing the inconvenience arising from Smoke in Chimneys, which he denominates a Windguard. Dated April 25, 1826.—In six months.

To John Williams, of the Commercial-road, in the county of Middlesex, ironmonger, and ships' fire-hearth manufacturer; for certain improvements on Ships' Hearths, and apparatus for Cooking by Steam. Dated April 27, 1826.—In two months.

To William Choice, of Strachan-terrace, auctioneer; and Robert Gibson, of White Conduit-terrace, builder, in the parish of St. Mary, Islington, in the county of Middlesex; for certain improvements in machinery for making Bricks. Dated April 27, 1826.—In two months.

To Charles Kennedy, of Virginia-terrace, Great Dover-road, in the county of Surrey, surgeon and apothecary; for certain improvements in the Apparatus used for Cupping. Dated April 29, 1826.—In six months.

To John Goulding, a citizen of the United States of America, but now residing in Cornhill, in the city of London, Esq.; for certain improvements in the Machines used for carding, slubbing, slivering, roving, or spinning, Wool, Cotton, waste Silk, short stapled Hemp and Flax, or any other fibrous materials or mixtures thereof. Dated May 2, 1826.—In six months.

To Arnold Buffum, late of Massachusetts, in the United States of America, but now residing in Jewin-street, in the city of London, hat-manufacturer, (being one of the people called Quakers,) and John M'Curdy, of Cecil-street, Strand, in the county of Middlesex, Esq.; who, in consequence of communications made to them by a certain foreigner residing abroad, and discoveries made by themselves, are in possession of an invention of improvements in Steam Engines. Dated May 6, 1826.—In six months.

To Sir Robert Seppings, Knt. a commissioner and surveyer of our navy, of Somerset House, in the county of Middlesex; for certain improvements in the construction of Fids, or apparatus for striking Top-masts and Top-gallant-masts in Ships. Dated May 6, 1826.—In six months.

To William Fenner, of Bushel-rents, Wapping, in the county of Surrey, carpenter; for an improvement in machinery or apparatus for curing smoky and cleansing foul Chimneys. Dated May 6, 1826.—In six months.

To Alexander Allard de la Court, of Great Winchester-street, in the city of London, Esq.; for a new instrument and improvements in certain well known instruments applicable to the Organ of Sight. Dated May 6, 1826.—In six months.

To Joseph Schaller, of Regent-street, in the county of Middlesex, ladies' shoe-maker; for certain improvements in the construction or manufacture of Clogs, Pattens, or substitutes for the same. Dated May 6, 1826.—In six months.

To Edward Heard, of the parish of St. Leonard, Shoreditch, in the county of Middlesex, chemist; for a certain new composition or compositions to be used for the purpose of washing in Sea and other Water. Dated May 8, 1826.—In six months.

To Levy Zachariah, jun., of Portsea, in the county of Hants, pawnbroker; for a combination of materials to be used as Fuel. Dated May 8, 1826.—In six months.

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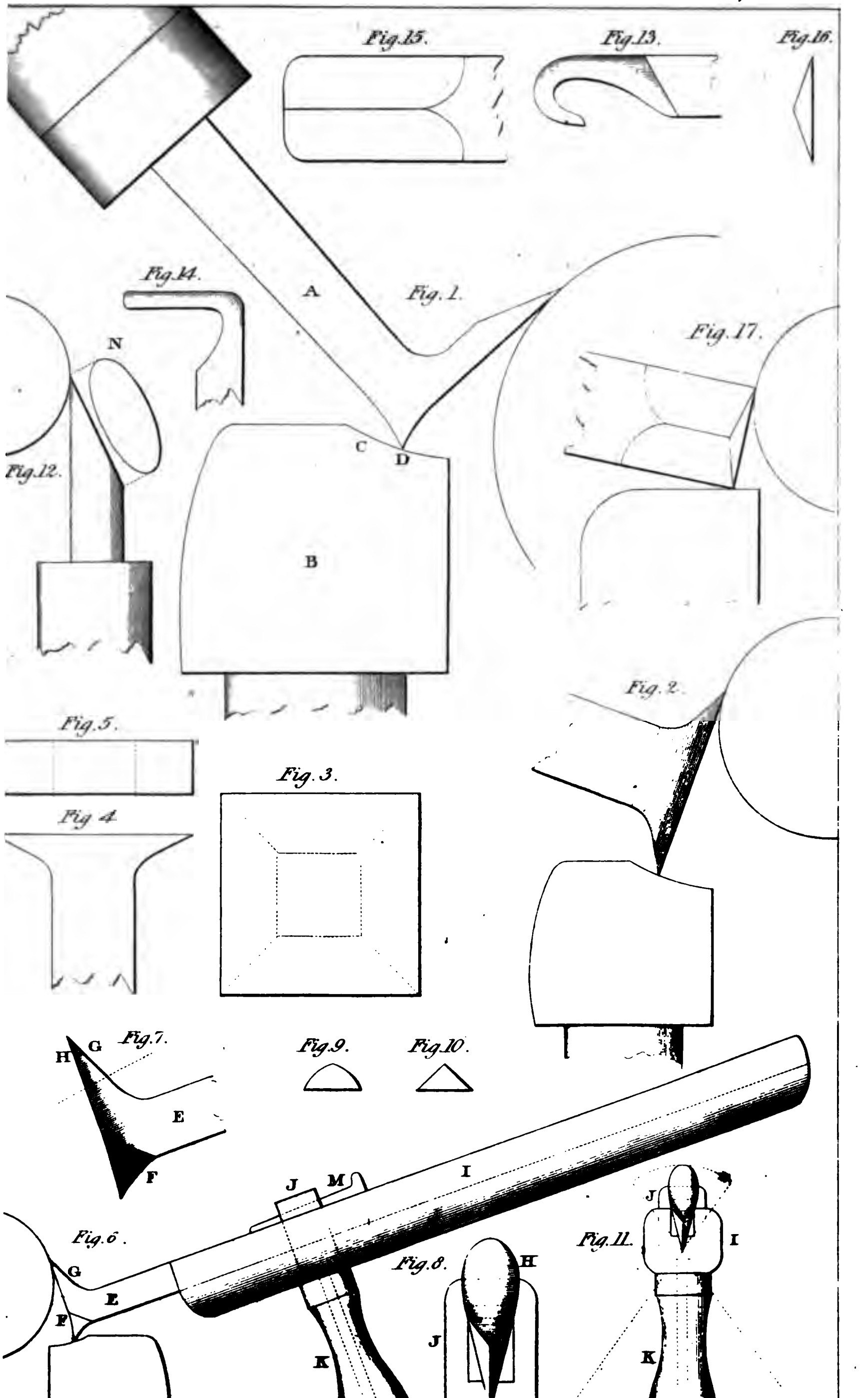
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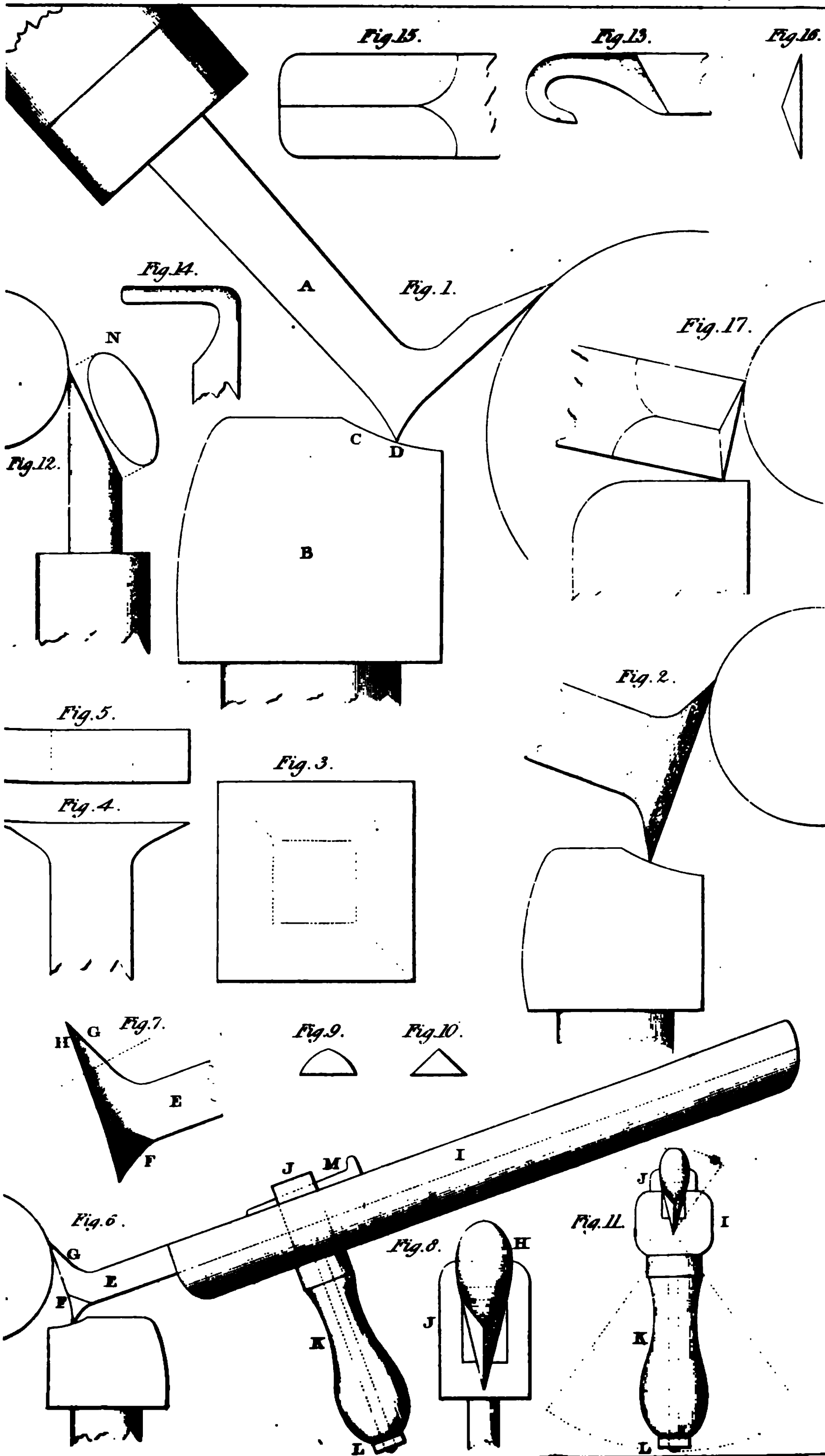
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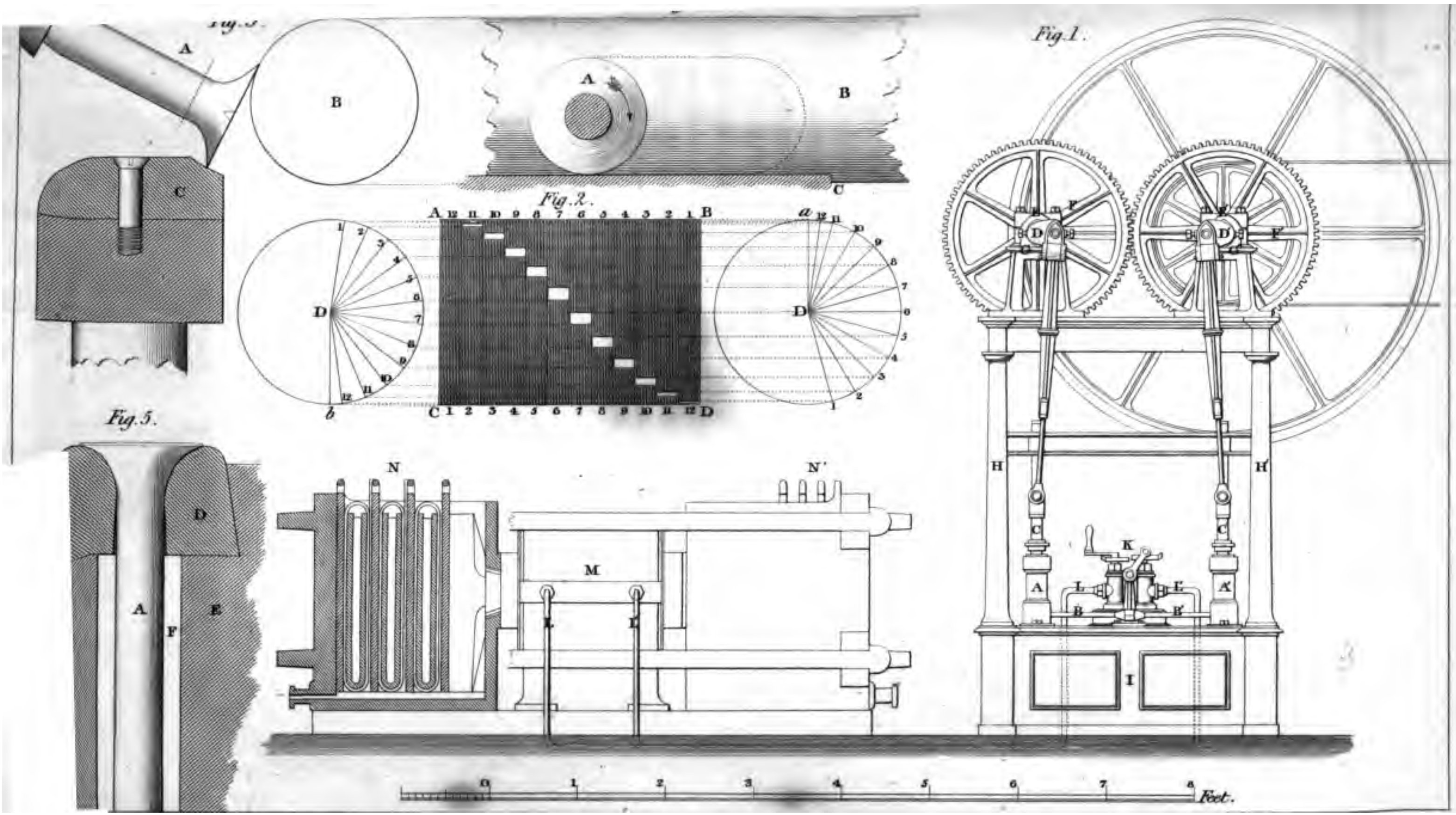
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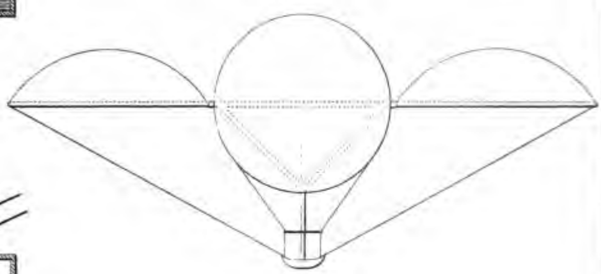

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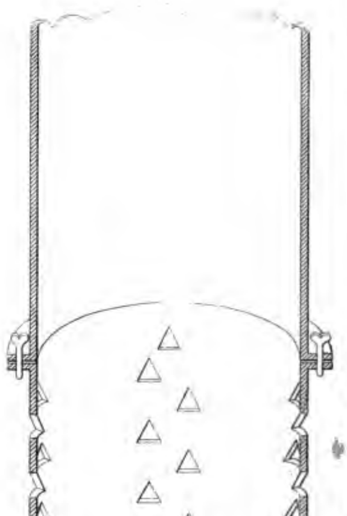

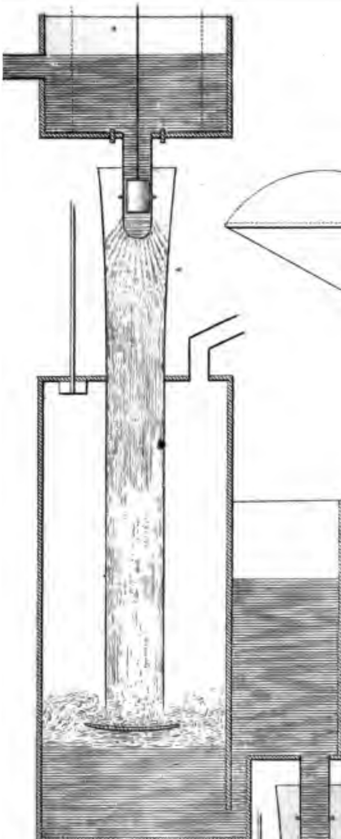

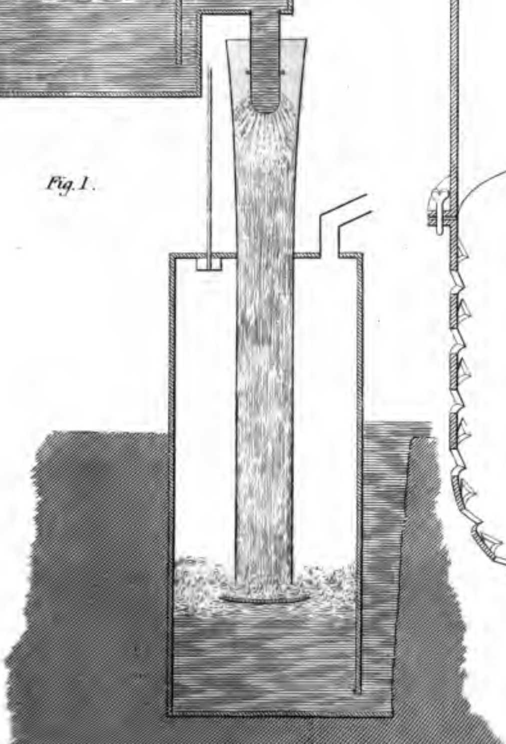

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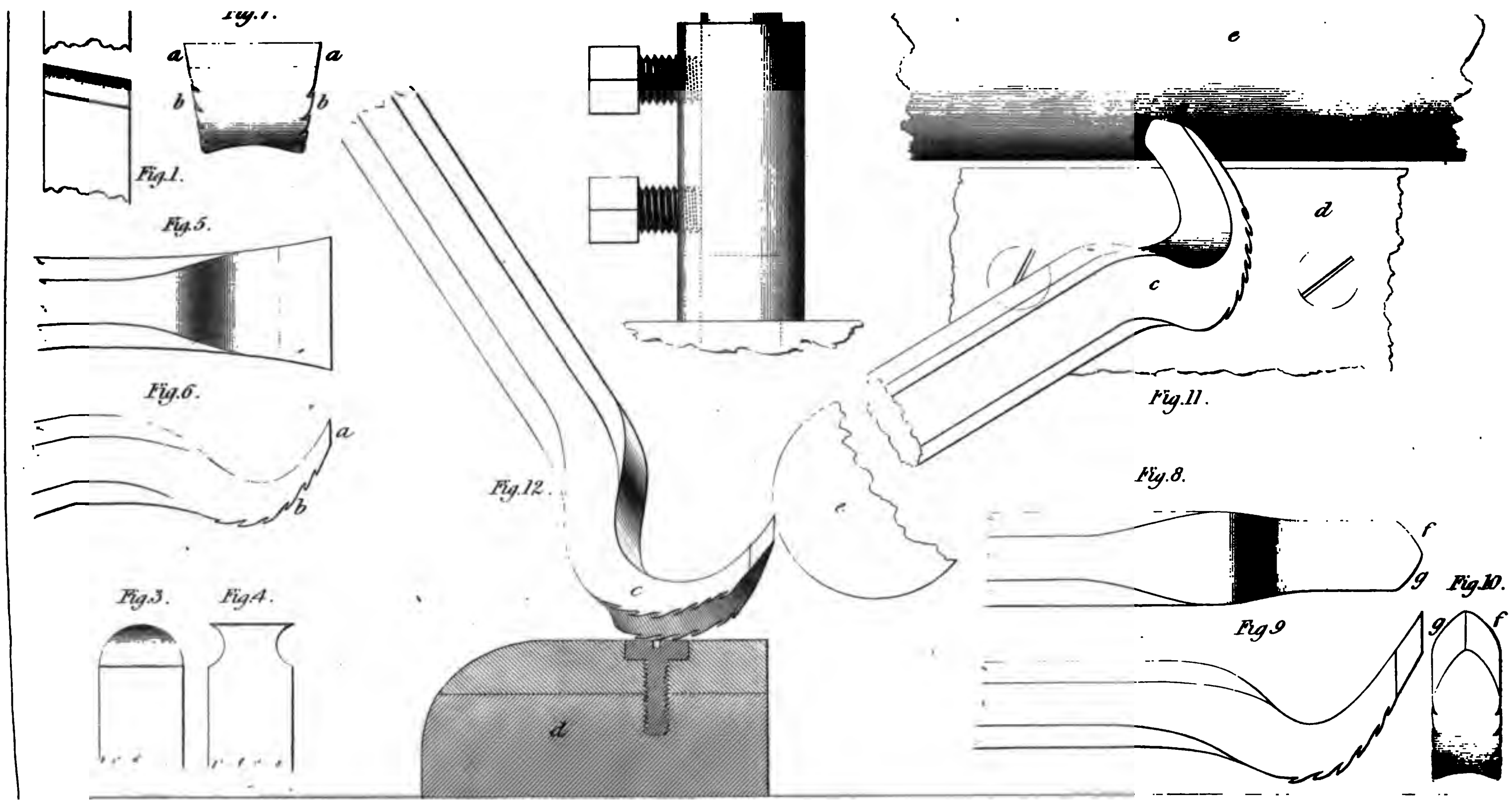

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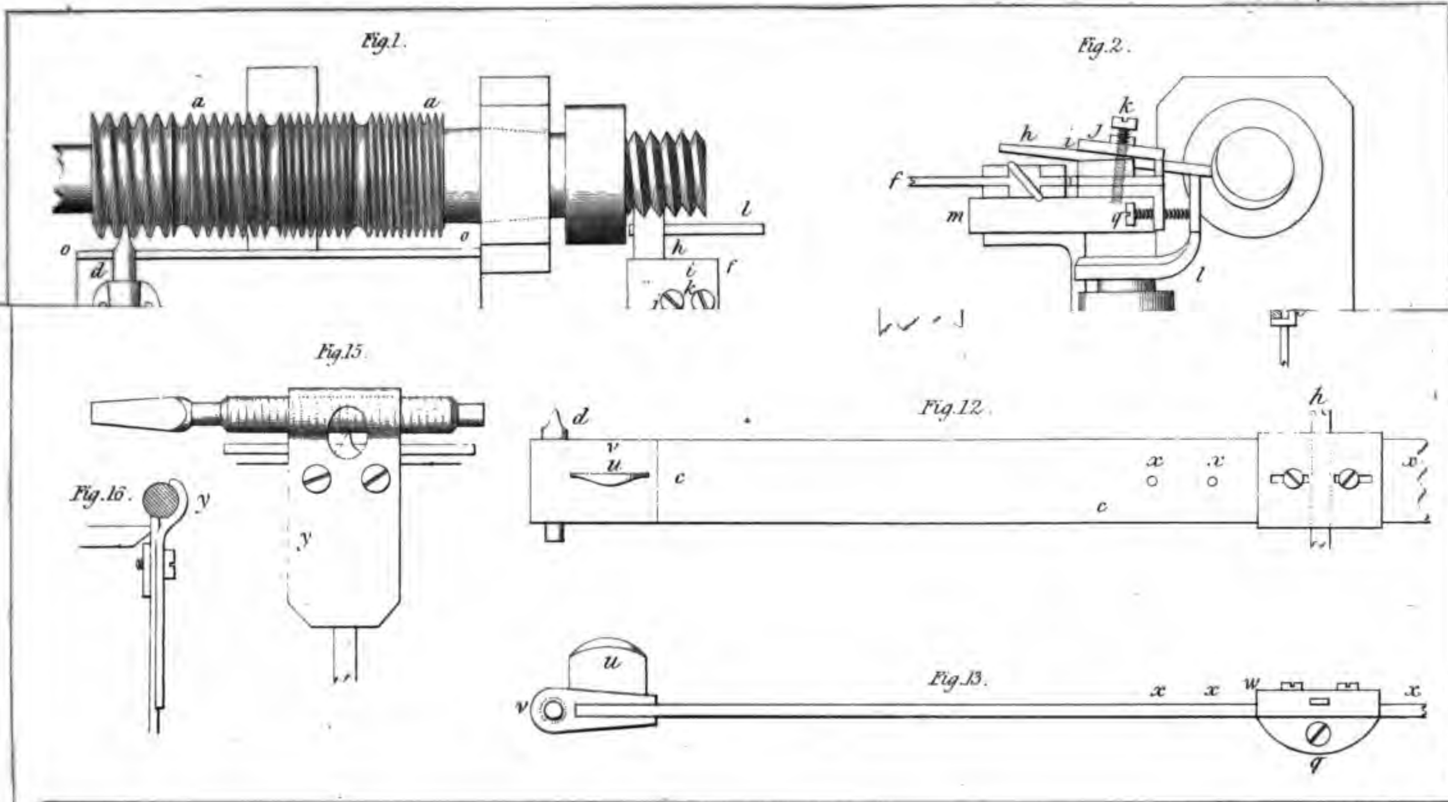

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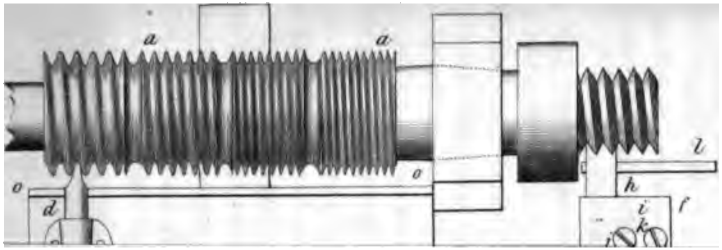

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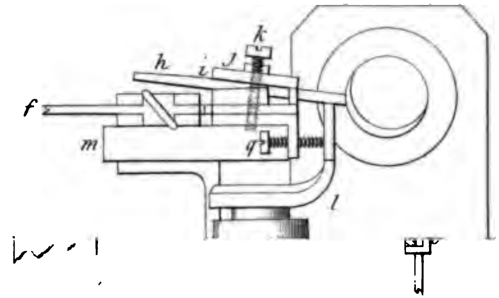

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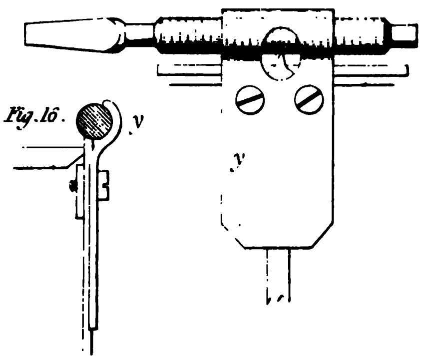

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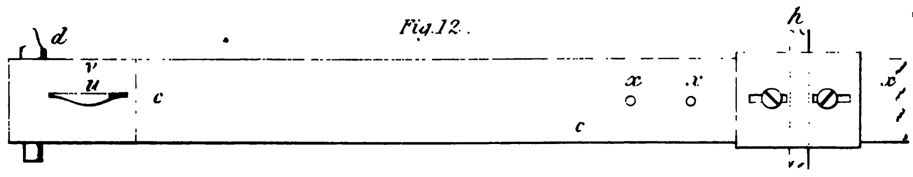

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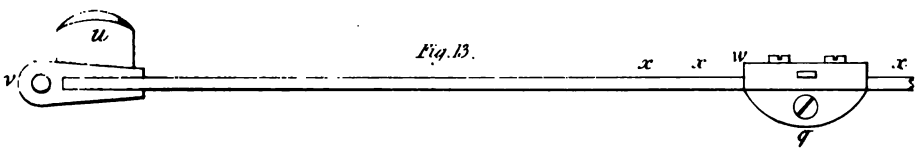

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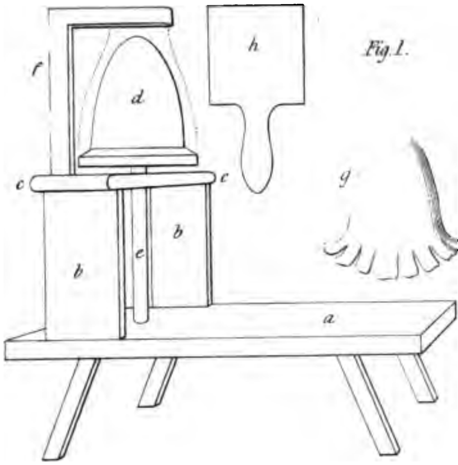

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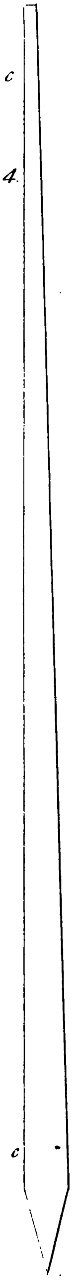

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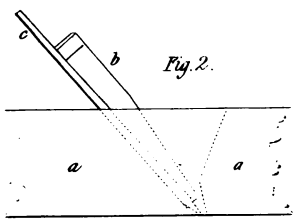

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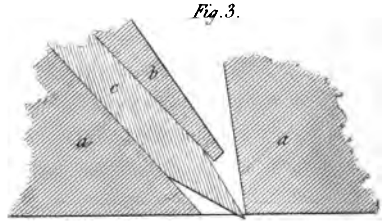

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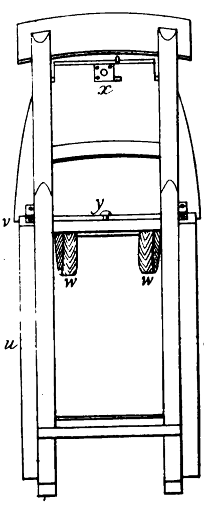

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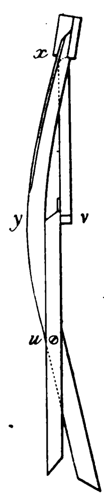

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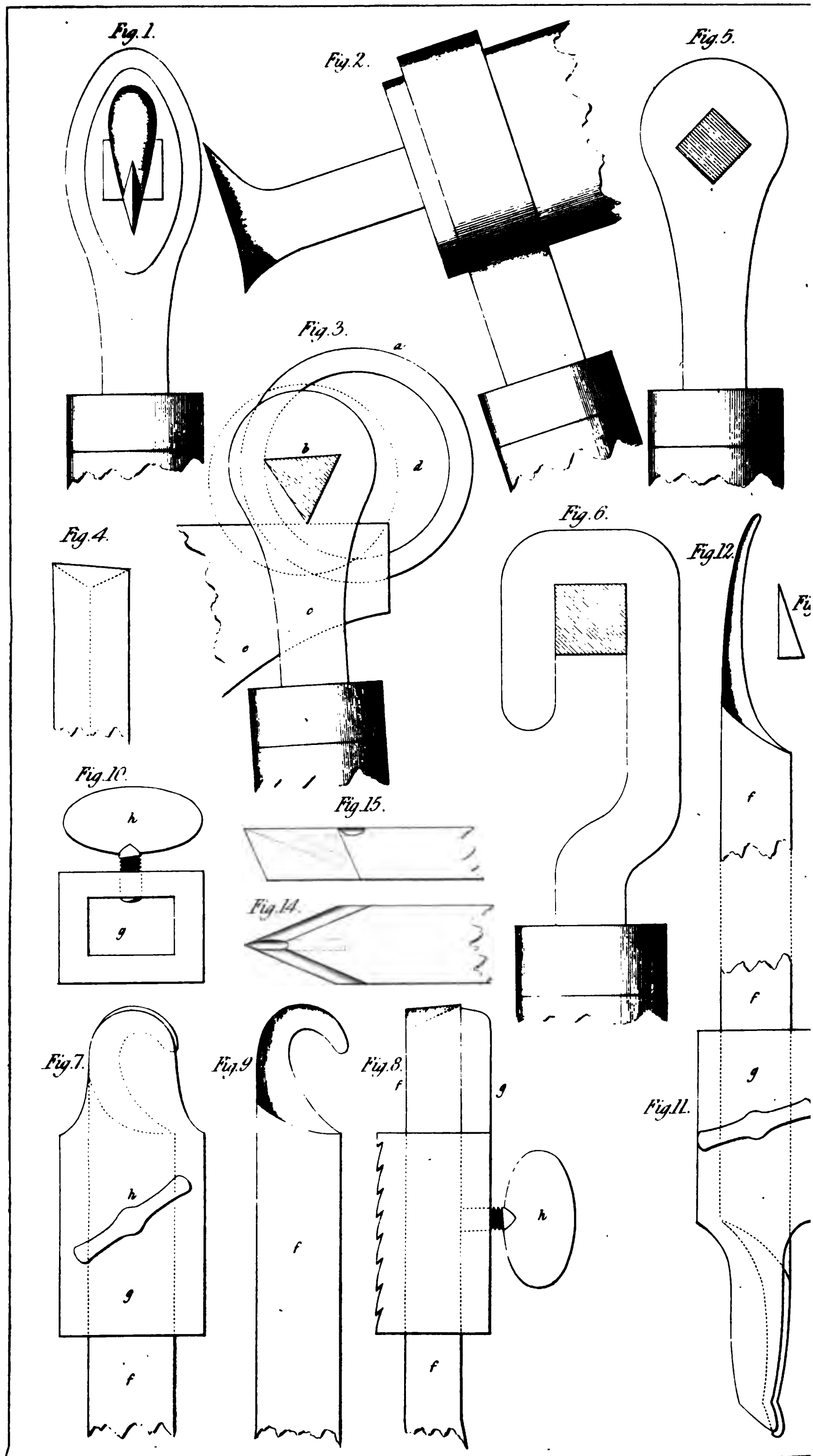
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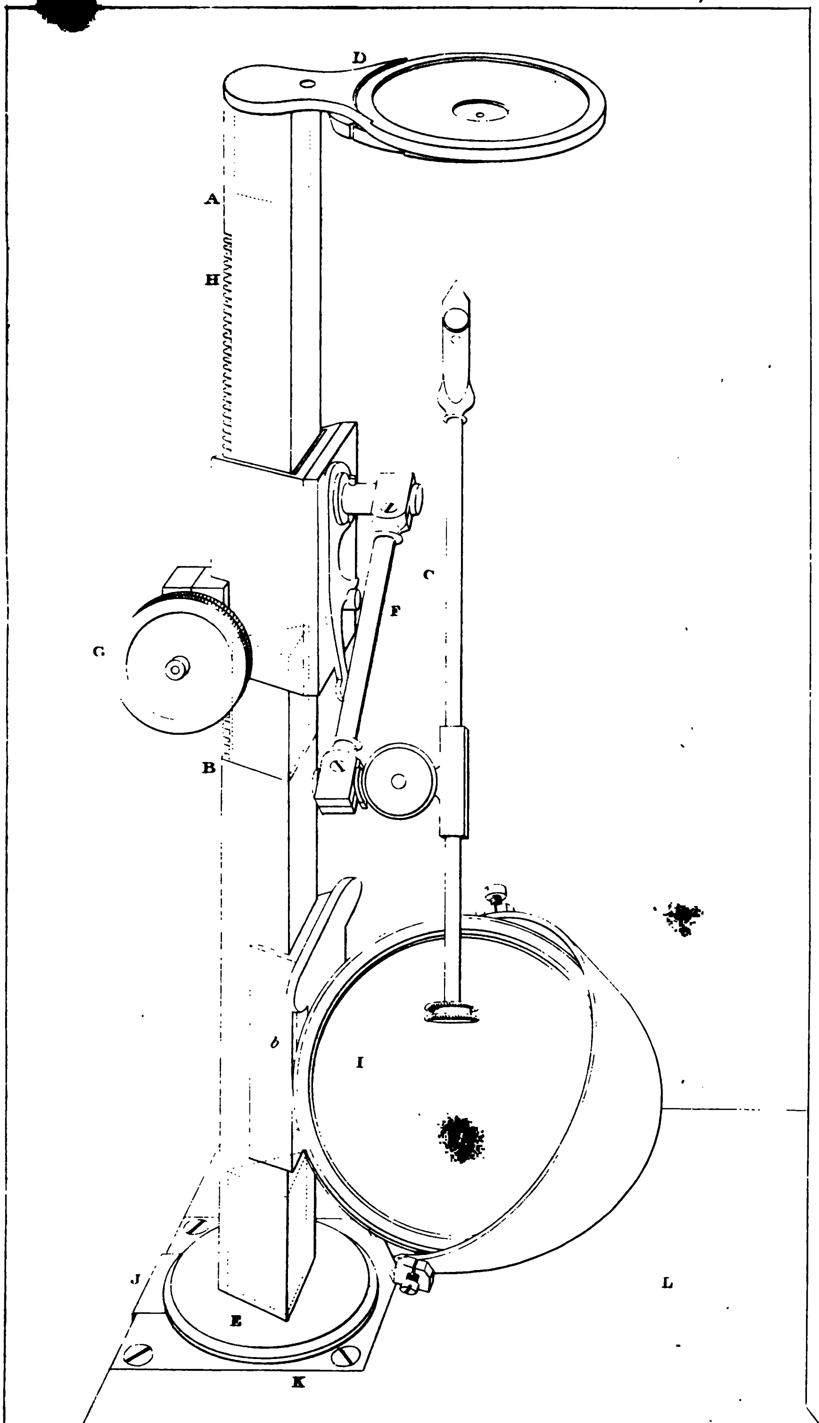

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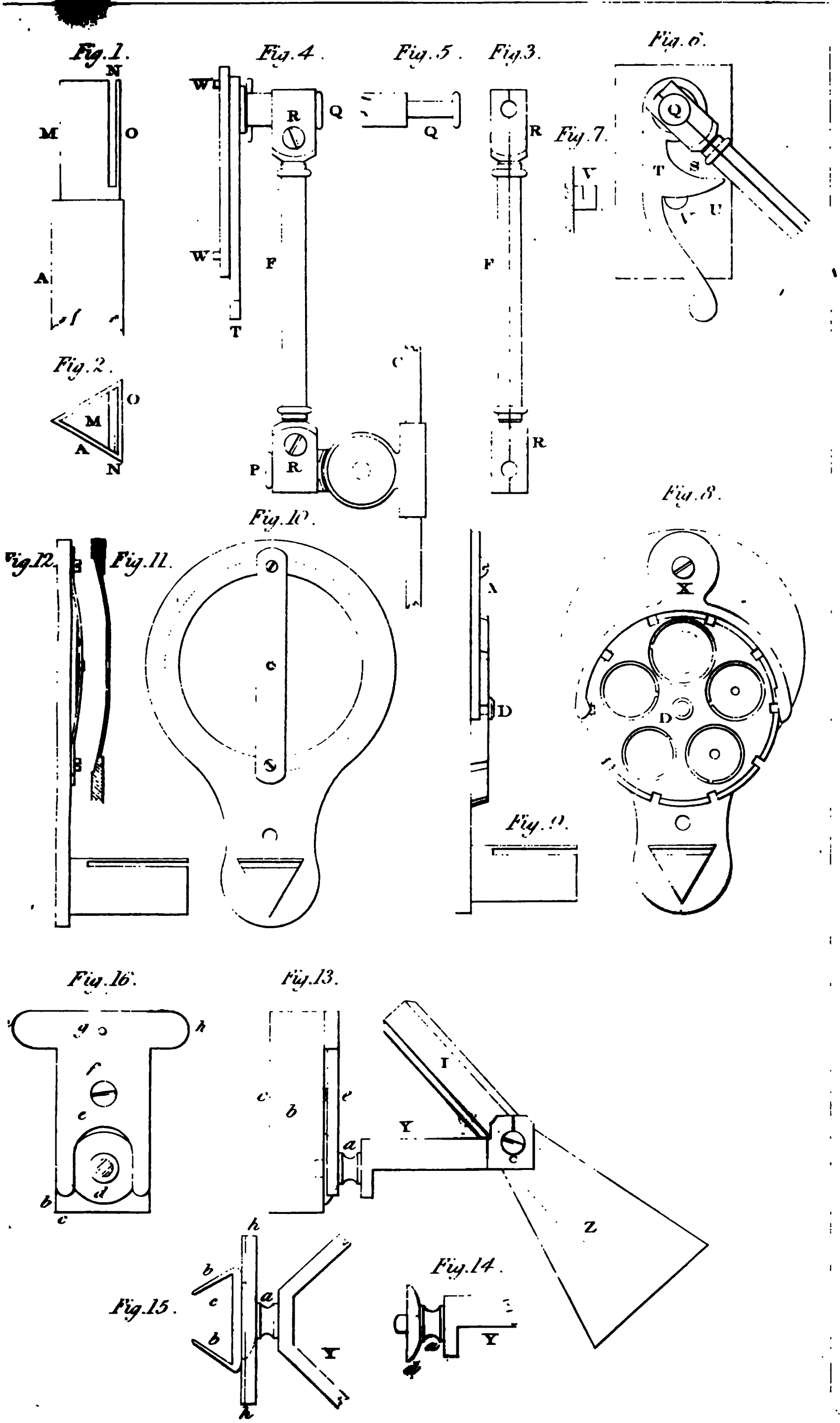
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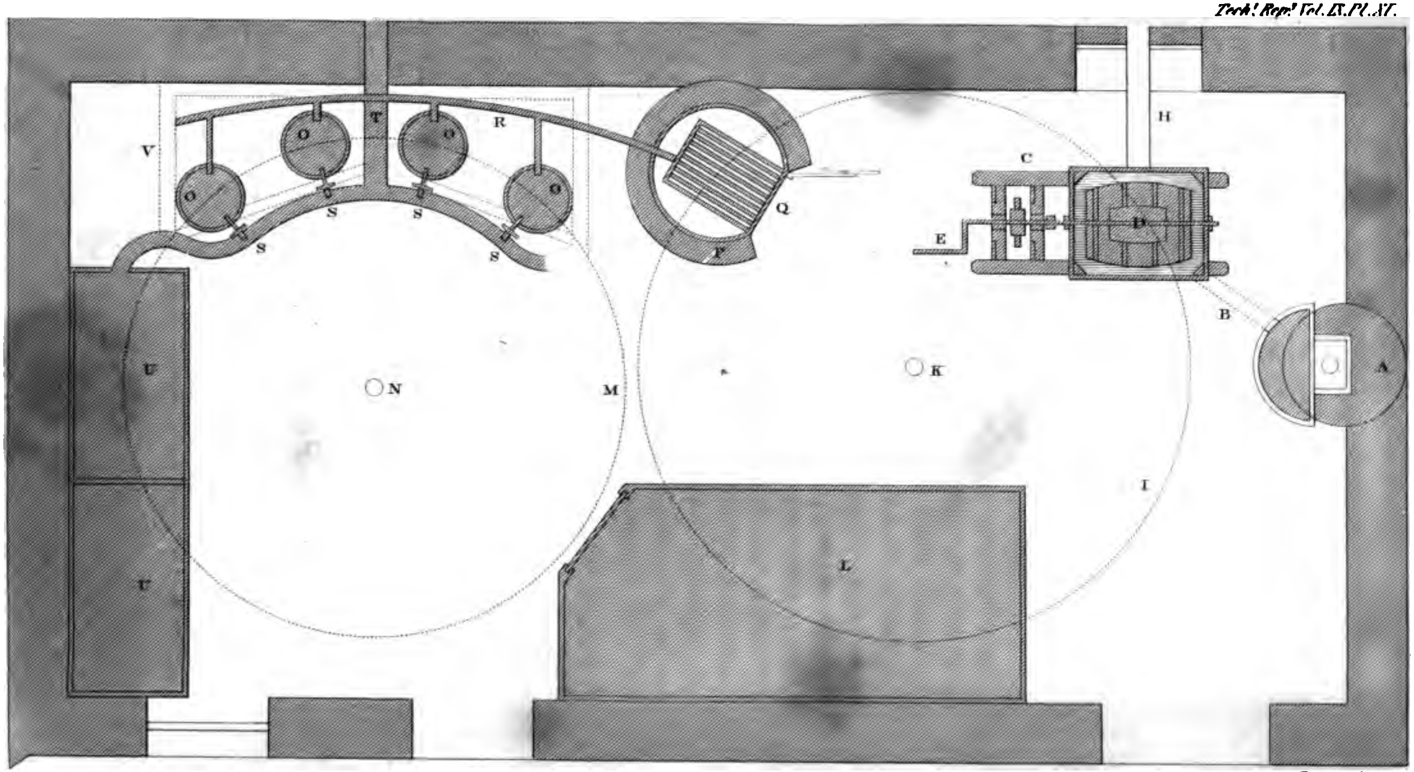

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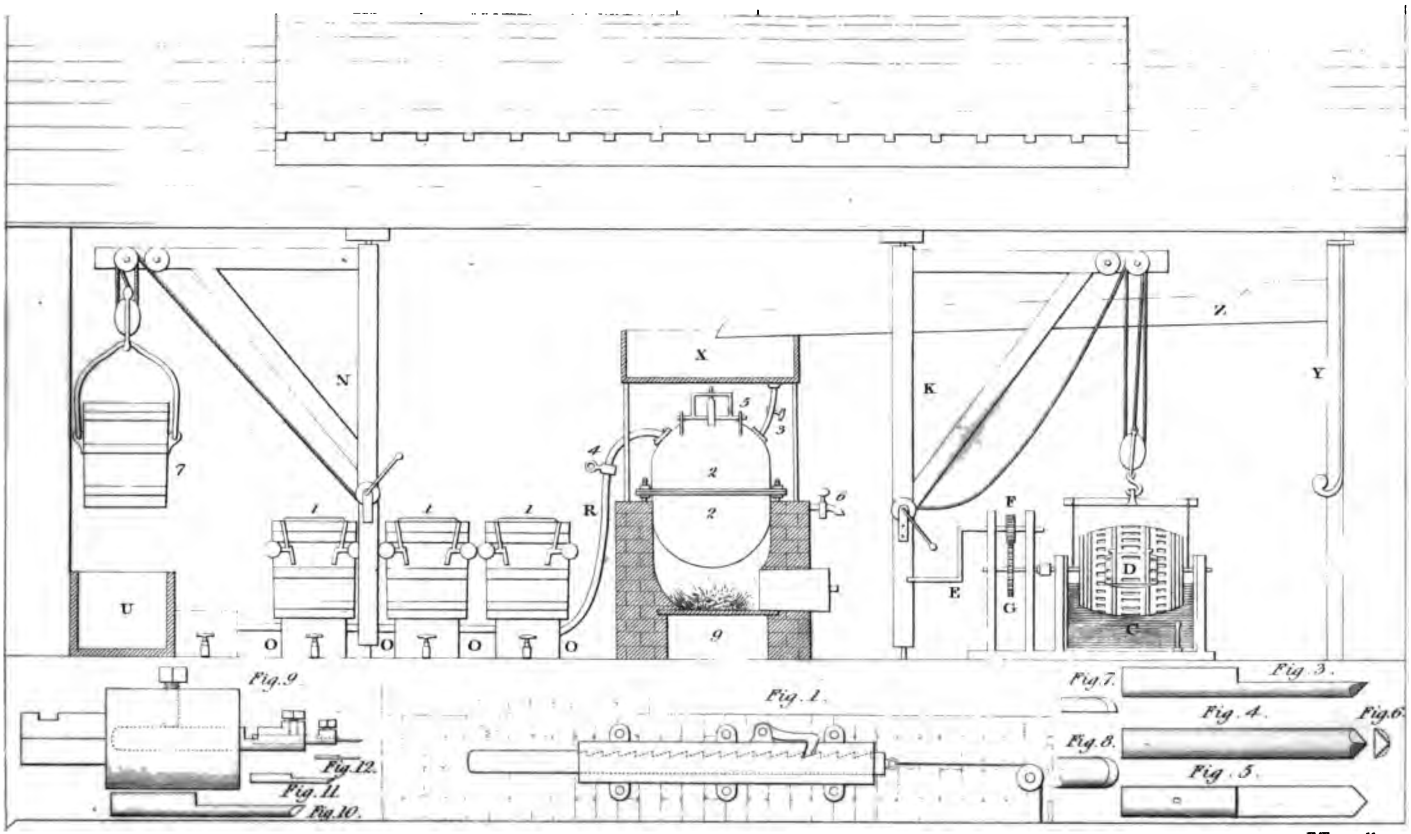

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